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Music and Architecture: An Interpresence

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MUSIC AND ARCHITECTURE: AN INTERPRESENCE

A Thesis Presented

By

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I am forever amazed by the music teachers at the Madison Metropolitan School District, who fought to keep the arts alive, and, in doing so, significantly impacted the lives of thousands of students.

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ABSTRACT

MUSIC AND ARCHITECTURE: AN INTERPRESENCE

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Having an extensive background in classical music performance and theory, as I began to explore architecture, I immediately noticed profound similarities between the two art forms. After additional research, I found that I was but one among many who had explored this relationship. What is most fascinating about the history of the long-standing interest in music and architecture is the richness of variation amongst the attitudes, inspirations, and discoveries that have come forth from within the union. This variation confirms the robustness of this concept as a source of inspiration not only for architects and music theorists, but also for cross-disciplinary thinkers.

The goal of this thesis is two-fold. The first is to distill and illuminate the most powerful aspects of the relationships between music and architecture. The findings are presented in sections **I, Background Research** and **II, Case Studies**. Section I contains a survey of a variety of points of contact between music and architecture. Section II explores how these points of contact have been manifested in precedent works by architects and in personal experiments.

The second goal of this thesis is to synthesize the above information and enact it upon an architectural design, as presented in sections **III, Existing Site & Program** and **IV, Design**. This is accomplished through a series of translations of musical strategies (such as rhythm, syncopation, and melody) upon the building blocks of architecture (including massing, circulation, and spatial arrangement).

TABLE OF CONTENTS

Page

LIST OF FIGURES

Figure Page

CHAPTER 1

BACKGROUND RESEARCH

a) Why study music and architecture?

Creativity within the human consciousness is sparked through experiencing the works of others. An architect may be inspired by the works of another architect. Or, an architect may be inspired by an artist of a different genre, such as a painter, a writer or a performer. An architect may also find inspiration in works that reside within other disciplines; physics, geography, biology. Why do specific works or inquiries inspire architects? And what are the benefits and the drawbacks of gaining inspiration from cross-disciplinary sources? Ultimately, inspiration is a source of creativity, so questions of how and why need no justification. Nevertheless, before delving into the topic of music and architecture, it is illuminating to first dissect and understand why music is a particularly rich source of inspiration for architecture. In essence, this hinges on the fact that music and architecture share a large number of fundamental underlying parallels, which are outlined in this following section.

i. Historical accounts of the relationship between music and architecture

The relationships between music and architecture have long been a subject of interest not only for architects and composers, but also for artists and thinkers from across disciplines and across centuries. The following series of quotations exemplifies this long-enduring interest:

"[M]usic is architecture in a fluid state and architecture is frozen music..." Schlegel

"Music is geometry translated into sound" Schiller

"Music, like architecture, is time and space." Le Corbusier

"A composition is like a house that you can walk around in." John Cage

"It is perfectly true that music and architecture flower from the same stem....My father...taught me to see a great symphony as an edifice, an edifice of sound." Frank Lloyd Wright

"Music and architecture have the common property of putting us inside a sensorial whole different from that we ordinarily live in." Violet Paget

"Music, like architecture, is an immersive experience; it surrounds you. One can turn away from a painting or a work of sculpture, while music and architecture engulf the body in space." Steven Holl

"...[W]hen I see a plan, I must see the plan as if it were a symphony, of the realm in spaces in the construction of light." Louis Kahn

"Music needs to be performed. Architecture needs to be executed. Then its body can come into being. And this body is always sensuous." Peter Zumthor

Each of these interpretations of the relationship or transposition between music and architecture is distinctive, and each seems to offer a varied understanding. This suggests that music and architecture share a strong yet enigmatic connection that is rooted in the deepest most fundamental essences of these two art forms.

ii. Abstraction

Deep within an individual, we can imagine an initial spark, an artistic impulse, which may bring about singing, moving, drawing, sculpting, speaking or any of the myriad forms of human expression. Whether intentional or instinctual, this deep and abstract impulse is the birth place of art works. In effect, more than any other art forms, musical and architectural compositions remain most attached to this initial abstract origin, since they both retain a highly abstract form (Murray, 1956, p. 99).

This abstract nature of architectural and musical forms lies in the fact that they can never be entirely descriptive. In other words, they are never fully illustrations of concrete items or occurrences in our world. Surely, both often are suggestive of symbols or references, but this cannot dominate the work as in can in paintings, literature, and other art forms. In their purest forms, architecture and music may, in the words of architect and writer August Endell, "mean nothing and represent nothing and remind us of nothing...[but] move our souls deeply and powerfully (De Mille, 2011, 9)." In this way, the abstract essence of both musical and architectural works have the ability to impact individuals independent of any external references.

iii. Referentiality vs. Autonomy

Although the essences of architecture and music are gracefully abstract, both can be highly influenced by external forces (Zuk, 1983, 6). Circumstances including politics, culture, geography, and family can impact a work drastically or minimally. For instance, within the works of composer Jean Sibelius and architect Alvar Aalto, both of Finnish nationality, we see a deep inspiration from the distinctive landscape of their country. Imagine a motionless, frozen, snow-covered terrain with thick swatches of slender pine trees. This is the environment that engaged both Aalto and Sibelius since their youth, and it is also a distinctive part of the Finnish identity (Menin, 2003, 8). In the words of Aalto, "[p]roximity to Nature can give fresh inspiration in terms of form and of construction (Menin, 2003, 12)." This influence of nature and specifically the Finnish landscape is a ubiquitous force in both artists' works. Take for example Aalto's Villa Mairea and Sibelius' Symphony No. 1. Aalto's U-shaped house pulls nature inside to meet a textured collage of woods and natural materials standing open and tall like the pines of his

treasured landscape. In Sibelius' Symphony, a calm, nearly motionless clarinet solo is interrupted by a sharp sheet of ice that is the second violin tremolo, which is then overlain with a sensuous, gushing avalanche from the rest of the strings.

Figure 1. Alvar Aalto's *Villa Mairea,* interior
Image from: http://www.giesendesign.com

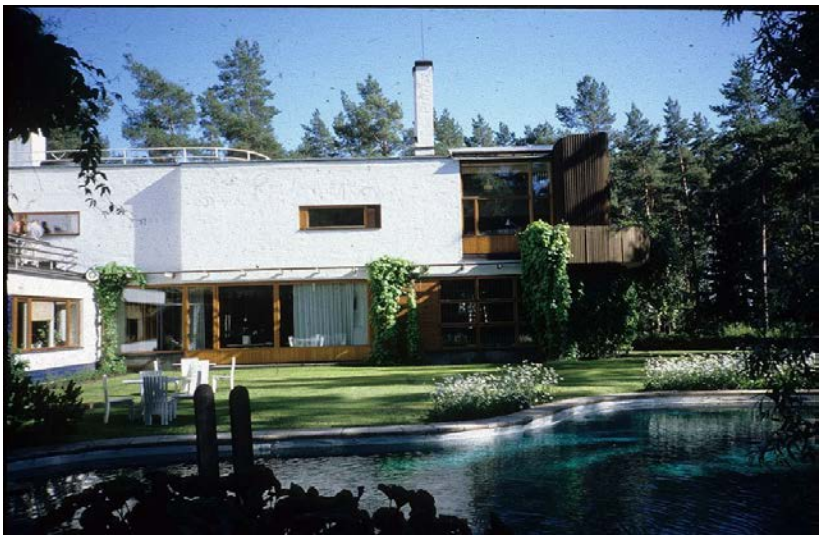


Figure 2. Alvar Aalto's *Villa Mairea,* exterior
Image from: http://www.mimoa.eu

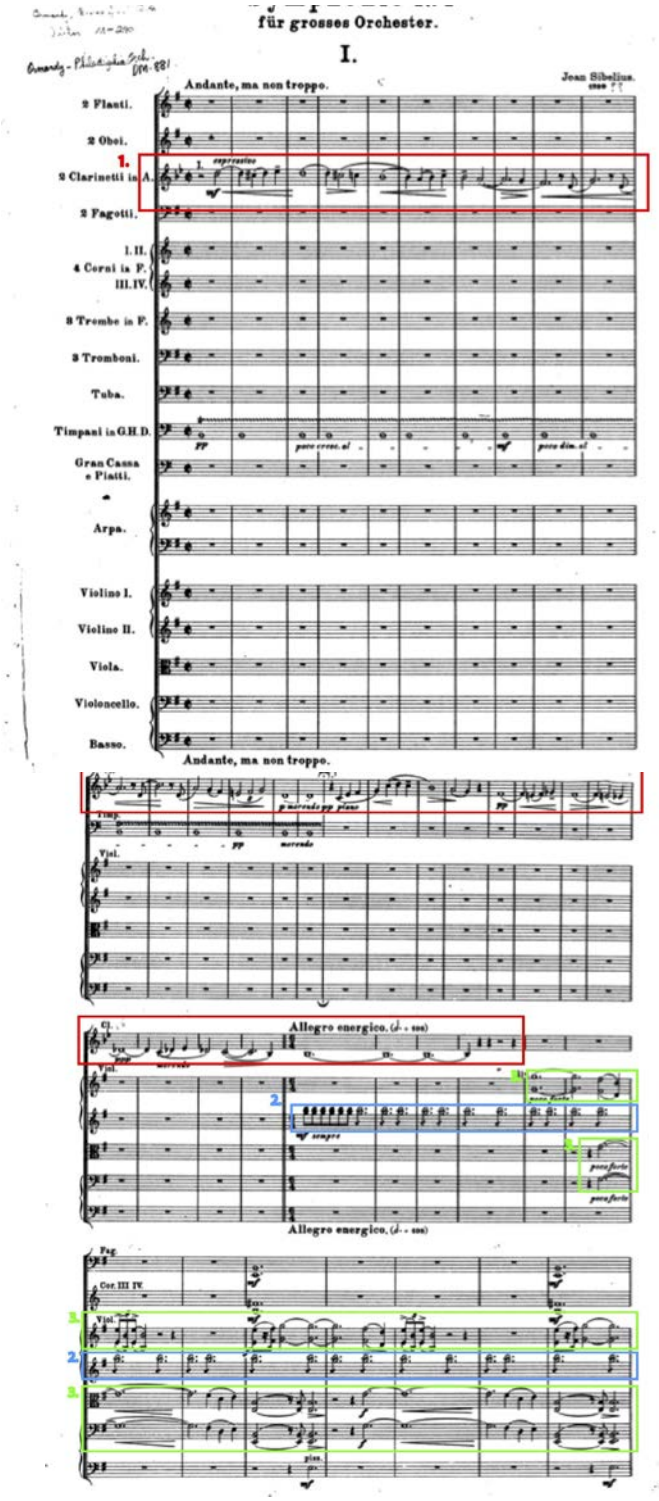


Figure 3. First two pages of Jean Sibelius' *Symphony No. 1*, with annotations
Image from: Jean Sibelius, Symphony No. 1, annotations by author

Calm, still clarinet solo (1) is sliced by the "sheet of ice" tremolo (2) and then covered by the sumptuous avalanche of strings (3).

Nevertheless, even in cases where an external force profoundly influences a work, such as nature in the works of Sibelius and Aalto, the works still sustain a musical or architectural existence that is independent of the external forces. In other words, the work offers abstract artistic and emotional value that does not rely on the external forces, and a viewer or a listener can enjoy the work with no knowledge of the underlying influences (Zuk, 1983, 3, 6). Radoslav Zuk, architect, musician and professor at McGill University, describes the artistic and expressive quality of music and architecture as “autonomous,” even in the face of intense external forces. For example, Hector Berlioz' Symphony Fantastique is full of symbols and references to a story, yet it still exists as a pure work of music that is moving regardless of whether one is familiar with the underlying themes.

iv. Usage of standardized notation

Legend has it that W.A. Mozart composed entire pieces of music within his mind prior to setting a single drop of ink to paper. In fact, by studying Mozart's manuscripts, historians have found that this was not the case. Rather, like many composers, he developed excerpts, themes, and energies in his mind, wrote them down, and then used musical notation to work out the rest of the piece (Shaw-Miller, 2006, 38). Similarly, an architect may construct and visualize initial aspects or schematics of a building in his or her mind, before transferring them to paper, using sketching and graphic notation to work out other elements of the design and the details. In this way, the processes of developing a piece of music and an architectural design through experimental sketching and symbol notation systems are parallel (Zuk, 1983, 4).

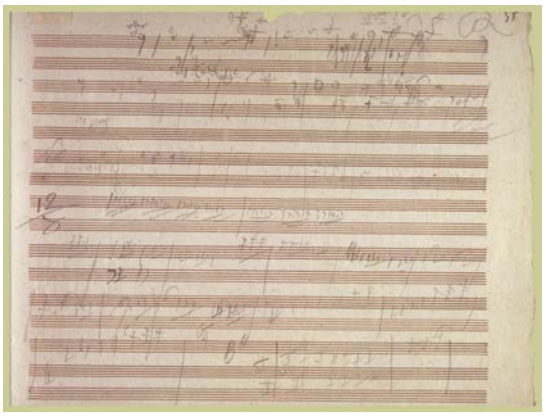


Figure 4. Sketch by Ludwig von Beethoven
Image from: http://www.mfiles.co.uk/manuscripts-pens-and-composers.htm

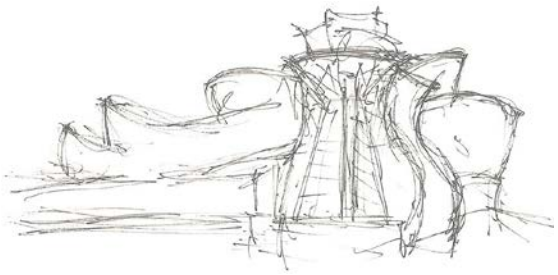


Figure 5. Sketch by Frank Gehry
Image from: http://www.cityofsound.com/

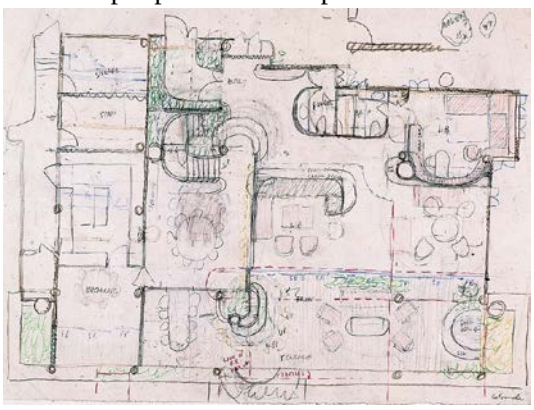


Figure 6. Sketch by Paul Rudolph
Image from: http://www.paulrudolph.org

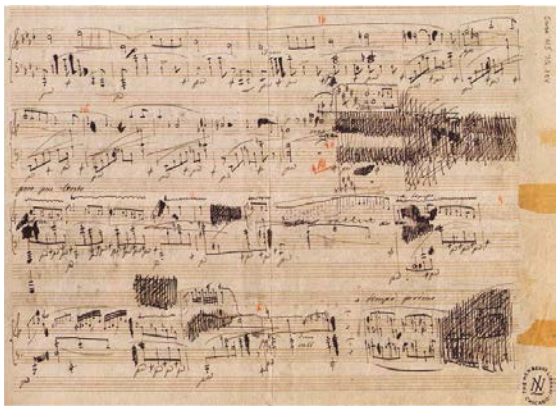


Figure 7. Sketch by Frédéric Chopin Image from: http://www.finebooksmagazine.com

As we develop a piece of music or architecture, we use notation to explore and refine the project. In our tradition, this process will ultimately lead to a completed musical score or a set of construction documents. However, these completed documents do not constitute the work itself. Rather, these completed documents are the intermediary between the architect or composer's vision, and the actual instancing of the work, which is constituted by the erection of the building or the performing of the piece of music (Shaw-Miller, 2006, 38).

In effect, the notation systems used in the musical score and the construction documents are abstract representations of the work of music or architecture (Zuk, 1983, 4), created as a means to communicate the work to the performer or to the builder, but

also as a means to take preliminary impulses and ideas and work them out on paper. Thus, a work of music or architecture does not fully come not fully come into being until it is erected or performed (Holl, 2013).

Figure 8. Musical and architectural symbols: inverted mordent, door, fermata, studs, respectively
Image by author

These symbols do not dictate a specific object, but rather, they signal the builder or performer to access their understanding of what this object is, based on the given description, information, context, etc.

In the eloquent words of Simon Shaw-Miller, art and music theorist and professor at the University of London, "[s]core is an object that embodies the work, but does not encompass its full identity (Shaw-Miller, 2006, 41)."

Herein lies a unique similarity between the process of creating a musical composition and an architectural work. Upon completion of the score or the drawings, the work has not yet come into full existence for two reasons: First, in the sense that it is not yet accessible for individuals to experience. In effect, the work can only be accessed by individuals in the everyday world by erecting the building or performing the music (Nannicelli, 2011, 408). Second, musical and architectural works are created for the physical world, and they are notated to give rise to intentional consequences (carried out by the performer or the builder) that cannot be expressly embodied in the notation itself. Thus, until the notations are born into the conditions of the exterior world, they are figuratively flat.

v. How/when does a work become a work? – Transmission

Although a completed score or set of construction drawings does not constitute the full identity of a work of music or architecture, the work does in a sense exist before construction or performance (Nannicelli, 2011, 408). The work exists in the sense that it is a response to an impulse that originates from within the composer or architect, so the work exists as soon as it is hashed out, or arguably, as soon as the impulse is acted upon.

Yet, although it exists before being erected or performed, as described above, it is not yet accessible to individuals of the world. Thus, the creation of the physical building and the performance of the musical composition *is a part* of the work in its full identity. In this way, Peter Zumthor describes performance is the "point of delivery" of fullness of the original musical idea (Holl, 2013).

vi. Instancing and traditional roles & participants

As we think about this process through which a score or a set of drawings enters our physical realm, and achieves its fullest identity, it is interesting to consider how this occurs in a vastly different way for buildings and for music. The difference is that a set of construction documents gives rise to *one* building, and the material object that is the building *becomes* the work. Contrarily, a musical score gives rise to infinite performances, and each performance is an instance of the work (Nannicelli, 2011, 408). Unlike a building, an individual performance is not the work itself. For example, when we speak of the Villa Savoye, we are speaking of the physical building, not of the documents that were used to build it. Contrarily, when we speak of Beethoven's 9th Symphony, we are not speaking of a specific performance, or instance, of the work, but

of a work that lives in the realm of Beethoven's eternal repertoire, that may be re-instanced at any time.

The implications of this difference are suggestive. Say, for example, the Villa Savoye was destroyed. We would understand the work itself to be destroyed, despite its memory living on. And, even if a new building was constructed from the exact same documents, in the same location, by the same builders, from the same material, we would not accept this as the same building. On the other hand for musical works, clearly this is not the case. Each time that a composition is performed, even if one performance is wildly different from the next, they are all instances of the same work. In fact, this *interpretive* quality of music, which allows the performer a window of leeway in taking what the composer has created and transmitting it to the world, is one of the celebrated and admired aspects of music. When we refer to a musical performance, we want to know who composed the piece and also who is performing it. We may go to a concert because we enjoy the composer, or because we enjoy the performer. This is not so with a building. Most often, in studying and visiting buildings, we speak of the architect, but rarely do we speak of the builder. Both architecture and music, in their fullest identities, are dialogues between the creator, the maker, and the receiver (Shaw-Miller, 2006, 46). Yet, music is understood and received in this way, while architecture usually is not. This is a moment where architects can learn from music. There is an unquantifiable richness that the performer, *the interpreter*, imparts on the final existence of the work. This is not at all to say that the performer changes the essence of the work; rather, a skilled composer crafts his score in a way that sets up opportunity for variation in interpretation. Some elements of a score are notated strictly and specifically, and these ensure that the

essence of the piece will come through. But other elements are not as firmly dictated, allowing the performer to add his or her own flavor. It is as if the composer is using this varying level of specificity, this varying level of control, as another expressive layer within his work.

vii. Distortion and artistic constraint

Through the process of composing/designing, notating, reading, and performing/building, it is imperative to remember that the vehicle of notation is an abstract language of symbols that is not the work, but rather a representation of the work. This notion is so important because the standard of notation will impact the nature of the work. In other words, a standardized notation likely distorts or constrains the possibilities for artistic expression (Shaw-Miller, 2006, 38). It is for this reason that a wave of contemporary composers worked with *graphic scores*, which allow the composer to use notation in a fully flexible manner, to communicate the artistic impulse, rather than being constrained by the notation (Shaw-Miller, 2006, 41). Not only did these graphic scores allow the composer to move beyond the predetermined boundaries that traditional notation enforces, they also contributed to interdisciplinary dialogue about assumptions in art and academics.

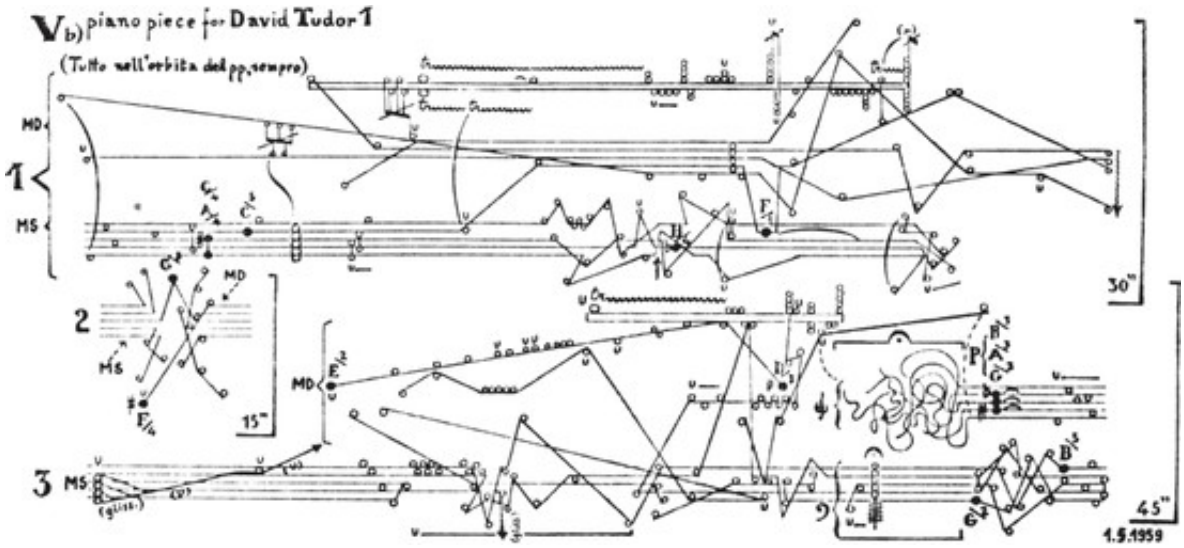


Figure 9. A graphic score by composer Sylvano Bussotti

This notion of the freedom of the graphic score was revolutionary in the evolution of classical music. However, so radical a shift in the notation and understanding of architecture has not yet occurred. Postmodern architects and theorists did take this queue, notably architect Peter Eisenmann, though this trend was never embraced and developed to the extent it was in the world of music.

b) Relationships between the primary constitutive elements of music and the poetics of architecture

When analyzing a piece of music, it is reasonable to break it down into the following main constitutive elements: rhythm, melody, harmony, instrumentation, and form. Each of these elements plays a specific role in defining the identity of a work of music. In addition, when considered within the context of the relationships between music and architecture, each of these elements has parallels in architectural design, and potential to inspire new architectural strategies and mindsets. These parallels were first discussed, briefly, in Architect James A. Murray's essay entitled *Parallels in Music and Architecture*, 1956, and are expanded upon in this thesis in the following sections.

i. Rhythm

Rhythm is the most fundamental and primordial core of music; rhythm keeps order. Rhythm in classical music is based on an underlying, steady, even pulse that is grouped most commonly into repeating sets of two, three, four or six. The type of grouping is referred to as the *time signature,* and each group of two, three, four, or six is referred to as one *measure*. The reason that the beats are grouped into measures, rather than just existing as a continuous steady stream, is because the grouping gives rise to a rhythmic hierarchy that creates a certain effect across the notes that are sculpted into the measures. The time signature is a sort of template that dictates the shape of a measure, giving rise to some notes that will be naturally accentuated and other notes that will not be accentuated, which is determined by their location within the measure. For example, a waltz, which is a common compositional framework, is always based on a time signature of three, meaning that there are three beats in every measure. Also, in a waltz the speed, or *tempo,* of the beats is at least moderately brisk. The first of the three beats is accentuated and the second and third beats are not accentuated. With this heavy first beat, followed by light, upward-flowing second and third beats, along with the quick tempo, the shape of the measure takes on a round, free-flowing, forward-running shape. Thus, as a melody is laid over this rhythmic template, the rhythmic character of the waltz is imbued into the music.

Not all compositions in the time signature of three are waltzes; the waltz is only one of a large number of types of compositions written in three, and thus is only one of a large number of possible templates and shapes that can arise from a piece written in three. For example, Movement 1 of J.S. Bach's Second Suite for Solo Violoncello is written in

three, at a moderately slow tempo. Here, the melodic and harmonic structures invoke an accentuated *second* beat, with the first and third beats functioning as connective tissue that leads to the accent on beat two. What is interesting in this example is that as the piece develops, the accent shifts occasionally to beat one or to beat three, as the melody and harmony meander and stretch. When the accent shifts to a different beat, a unique character is felt on those notes, ranging from energetic, to tense, depending on the melodic and harmonic context. As the piece develops even more, there are moments where we lose the accent altogether for a measure or two, as the melody and harmony take off running, building tension, until the original second accentuated beat finally returns, bringing along with it a sense of arrival or release.

In music, rhythm not only keeps order, but also defines order. Rhythm can define a character. Or, rhythm can create a structure that, when skillfully broken and distorted, creates expressive and colorful ideas, even before the other elements of music (melody, harmony, form, instrumentation) are introduced. These functions of rhythm resonate with the functions of rhythm in architecture. In architecture, rhythm can be defined by a massing pattern, a fenestration pattern, a structural system. Rhythm can even be defined by the spatial arrangement of rooms, how they repeat, connect, shrink, expand and deviate. Rhythm can be expressed by the articulated form of a façade. Rhythm can be expressed by how a building relates to adjacent buildings, or to other elements of its site; streets, paths, benches, trees.

In this way, examples of rhythmic frameworks in music may be applied conceptually to architectural schematics in order to generate expressive forms, and also to resolve scenarios where, disparate elements must be reconciled.

ii. Melody

Melody is a sequence of notes that navigates up, down, around, and through the timed measures. Melody is often based on a short *phrase* or musical statement/idea, that is then repeated, altered, rearranged, and elaborated upon. According to Murray, robust melody arises from good proportions, with a nice balance of high and low moments of intensity, a full continuity in sound and space while incorporating variation and emotional impacts (Murray, 1956, 38).

The role that melody plays in a composition is much less tangible that the role of rhythm. Melody is usually the most recognizable element of a composition. It is the element that is the most easily captured by the human mind. It is the most relatable and the most memorable. In a sense, it is the face of the composition, it is the immediate defining identity of the work.

Melody in music can be equated with the overall identity of a work of architecture. Like a good musical melody, a good architectural melody may also be defined by good proportions, a balance of high and low moments of intensity, and a spatial continuity that incorporates variation and emotional impacts.

iii. Harmony

Of the five constitutive elements of music, harmony is the most difficult to define, and functions on several different levels. In essence, harmony is based on associating different notes together, such that the intervals between them produce certain effects that are identifiable by the human ear, and invoke certain colors or moods to the human perception. One of the primary functions of harmony is to support the melody, by bringing it richness and depth. The harmony provides an underside to the melody, such

that the rhythmic underlay may relate. Harmony may also pivot a melody into different shapes and forms. The harmony, in many cases, is the mediator between the melody, melodic progression, and rhythmic underlay.

In architecture, there are two interesting ways to think about harmony. The first is to think about harmony as the relationships between the various rhythmic elements of a building, and the relationships of these rhythmic elements to the overall effect of the building as a whole. How does a fenestration pattern relate to the overall form of the building? How does the layout of the spaces relate to the overall site? How does the structural pattern relate to the fenestration and to the space layout? How can the space layout pivot the fenestration pattern as it moves across the façade? By looking at specific musical examples, we may apply the same logic that master composers have used for centuries, in order to help arrive at an elegant and authentic architectural solutions.

The second way to think about harmony in the context of architecture is how a new addition relates to an existing building or site. Music has an extraordinary amount of insight to offer in this regard, since compositions are comprised of many different musical ideas, textures, scales (sizes), intensities, ranges, instruments, and moods. From abrupt changes all the way to seamless growing and morphing, the musical repertoire exemplifies myriad types of transitions and relationships. By studying specific precedents in the musical repertoire, we can apply these strategies to architectural works.

iv. Instrumentation

In classical music, instrumentation refers to the set of instruments that are called for in a given composition. For example, the instrumentation for a string quartet is typically two violins, one viola and a violoncello. On the other hand, a piano quartet

commonly consists of one piano, one violin, one viola and one violoncello. Comparing these two examples, it is clear that by changing just one instrument, the whole identity of the piece of music changes. For another example, say one of the violins in a string quartet was replaced with a clarinet. Unlike a piano, a clarinet has similar capabilities to a violin. However, by adding the clarinet, the entire character of the piece will still change because of the *timber*, or quality of sound of the clarinet, which is much different from the violin.

In architecture, the role of instrumentation functions much like the role of materiality. The materials palette defines the final quality of the presence of a building. Say for example, one were to drastically change a material, for example from brick to polycarbonate panels; the complete presence of the project would shift. In this way, we can see that materials and instrumentation are meaningful parallels in the articulation of a piece of music or architecture.

v. Form

In musical theory, there are specific frameworks that are used to organize/structure pieces, based on sections of repetition and sections of contrast. For example:

-AAA (strophic)
-AB (binary)
-ABA’ (ternary)
-ABACA (rondo)
-AB C AB (sonata)
-AA’A’’A’’’ (theme-variations)

Each section has a specific function within a piece as a whole; together they define the identity of the piece. The sections are defined by specific relationships to the other sections and to the piece as a whole.

First off, musical form is a powerful tool for understanding and re-imagining the relationships between buildings and the relationships between buildings and site, and how their varying functions sculpt the identity of the site as a whole. On a smaller scale, musical form can also help to understanding the relationships between the programmatic parts within buildings.

Second, musical form also defines the scope of a composition. For example, the scope of a full symphony is much different than the scope of a string quartet, or a sonata, or a concerto. In this same way, a small residential work of architecture has a much different scope than a large housing complex, or an office building, or a museum. Scope does not necessarily imply complexity or size, but does imply the overall expected parameters for a work.

d) Phenomenology: Parallels in Music and Architecture Contribute to Human Perception

i. Creation of an immersive sensorial experience

Both architecture and music are significant parts of our everyday life, as are the many other art forms that shape our physical and mental world. Yet, there are certain experiential characteristics that set architecture and music apart from all other art forms. Most prominently, both architecture and music create fully immersive experiences for their receivers (Holl, 2013). When we are inside a building, or concentrated on a piece of music, we cannot simply turn away as one can with a painting. Rather, we remain involved in the experience of the building or piece of music at least until we leave the premises or the concert or shut off the recording. When we are experiencing architecture

or music, we are enveloped in its realm, we are encapsulated in a "sensorial whole (Blesser & Salter, 2007, 127)."

Furthermore, even for a most casual receiver, music and architecture have the power to sculpt an atmosphere. Enter an expansive vaulted cathedral, or pass through a dingy road-side diner, and whether one is aware or not, the architecture will create an atmosphere, an "existential state (Zuk, 1983, 2)." Enter the deep spirals and layers of a Rachmanninoff Symphony, or pass through the cliché whispers of waiting-room music, and whether one is aware or not, the music will create an atmosphere, an *existential state*. Whether one is actively engaged with a building or a music, or if one is simply a bystander, the ability of architecture and music to sculpt one's environment and mood is powerful.

According to writer and theorist Alain de Botton in *The Architecture of Happiness*, although architecture has a strong ability to shape one's mood, it is unable to enforce it (De Botton, 2006). The same holds true for music, as an individual in terrible spirits can hear the most spirited Mozart sonata without changing character. Nevertheless, a great deal of individuals have experienced the incredible power of music to impact emotional state, and many individuals use music on a daily basis to shape their mental state. Whether music is used to relax after a long day of work, or to calm nerves while studying, music holds a prominent ability to instantly alter the human conscious. In fact, it seems that music has a stronger ability to *enforce* its effect than does architecture.

Nevertheless, architecture has an enormous potential to shape our emotional state as well, we are just less aware of it. We choose spaces to relax in, to study in; we have certain spaces that comfort us. We alter the configurations of our spaces to evoke a

desired mood. We are disgruntled when our preferred spaces or conditions are altered or unavailable. In this way, music and architecture hold a profound grasp on our immediate emotional states, and it is impossible to imagine one's world without them.

ii. Implications of the inseparability of space and time

The reason that architecture and music so strongly impact our immediate emotional states is because they both exist in time *and* in space (Martin, 1994, 9). This is contrary to the musings of certain theorists, who have offered ideas like *architecture is frozen music* or *architecture is music translated into space.* The issue with these notions is that they only capture specific aspects of the relationship between music and architecture, and ignore the holistic complexly of the relationship.

So, instead, it is more fruitful to understand architecture and music each occupying both time *and* space. When we experience a building, we move through it. The winter sun may sink through the sky, casting shadows across a textured concrete wall. We turn the corner and feel the air reduce to a tingling chill, as a corridor opens out to a sunken garden. In this way, as we move through a building we are enveloped in a space-time experience that cannot be recreated in space or in time alone. In this same way, we sit in a concert hall or next to our stereo, and as the notes unravel they dance upon the surfaces that encage them. They ricochet off the vaulted ceiling only to return to caress our ears newly imbued with the character of the space that they have moved through. In the words of Simon Shaw-Miller, professor and art and music historian at the University of Bristol, “[m]usic registers through and in the body, as well as the mind. The experience of it is physical, intellectual, emotional and social (Shaw-Miller, 2006, 46).”

Architecture and music exist in space *and* time. Space and time are inseparable (Martin, 1994, 9).

iii. "Sensual vs. Expressive" or Instinct vs. Logic

Some works of music and architecture have an immediate and striking impact, yet many others of equal or greater value do not. For example the instantaneous shimmering warmth of Tchaikovsky's Violin Concerto No. 1 will grasp a listener from the first instance that he or she hears it. However, this is not the case for a thick and dark Mahler Symphony, which, upon hearing for the first time, may leave even the most dedicated listener lost. However, after a few more close listenings, the Mahler will begin to reveal its hidden secrets. Each successive listening will uncover deeper and deeper moments of wonder that may seem to whisper secrets of our universe. At the same time, the Tchaikovsky Concerto No. 1 may, after many listenings, cease to reveal moments of wonder.

The same dichotomy exists in architecture. Take for example the shimmering sweeps of Gehry's Guggenheim Bilbao or a Libeskind's Denver Art Museum, which are immediately enticing even to the least architecturally inclined visitors. Compare these works to the Unité d'Habitation, with its simple exterior form, that reveals profound secrets as one becomes acquainted with the strategies and ideas incorporated in the building. Thus, we can see that many great works are immediately accessible to viewers and listeners, and many great works are not. Similarly, some less meaningful or profound works may immediately dazzle, but may lose their value when analyzed at a deeper level.

How can we understand this dichotomy? Rather than dismissing it as purely subjective -- depending on the responses of individual viewers or listeners -- it is more

interesting to understand this as a tension between the "sensuous" and the "expressive" qualities of music and architecture (Murray, 1956, 100). The *sensuous* and the *expressive* are terms employed by architect and educator James A. Murray, who posits these as two distinct yet inseparable elements of architecture and music (Murray, 1956, 100). The *sensuous* describes the elements of a work that immediately charm us, seeming to speak directly to our soul. Before we can even think to analyze shapes or sounds, we are spellbound, mesmerized, connected to some element of the work, whether it is an undulating translucent facade that fades into the distance, or a glimmering thread of arpeggios that weave effortlessly through a dense knot of melody. In contrast to the *sensuous*, on the other hand, is the *expressive*. The *expressive* refers to a concept, a logic, a meaning, a rule that shapes or guides a work of music or architecture. The *expressive* elements of a work do not lunge forth and dazzle our fancy. Instead, they are quiet and deep-set within the spirit of the building or composition, and may be highly profound or inspiring. The difficulty is that an individual must invest effort before he or she is able to access and understand these *expressive* elements, and only then may he or she be touched or moved by them.

Some works of architecture and music have stunning *sensuous* draw, but lack an *expressive* depth. This type of work may appeal widely to a general audience, and enjoy generous popularity, but will not sustain long-term high regard. On the other end of the spectrum, some works of music and architecture lack a *sensuous* appeal, but embody a substantial philosophic or poetic *expressive* value. This type of work may suffer from a lack of attention from a general audience, since a general audience may perceive the work as confusing or uninteresting. However, this type of work will be able to attain a

sturdy and long-standing rank of respect. Most pieces of music and architecture, however, fall somewhere between these two poles, containing some combination of *sensuous* and *expressive* elements. It is the nature of this combination that will largely dictate the way that various audiences will receive a work of music or architecture. We may, for instance, be more immediately moved by a gothic cathedral than the Unité d'Habitation upon first glance, yet it is the Unité d'Habitation that will persist in our restless, searching minds. We may similarly be more immediately moved by the Tchaikovsky Violin Concerto than the Mahler Symphony, but it is the Mahler that will continue to reveal secrets and wonder each time that we listen.

It is tempting to assume that buildings and musical compositions with high *expressive* value and little *sensuous* value are more important, more worthy, than works that fall at the other end of this spectrum. However, a rule this general cannot hold true across the board. We can however, equate an elevated and sophisticated *expressive* value with inherent complexity within a work. Then, in turn, complexity in a work may or may not be equate to a more important or valuable building or composition. James A. Murray and Radoslav Zuk believe that complexity implies heightened value (Zuk, 1983, 4), but there is also substantial evidence that speaks otherwise. For example, outside of an academic setting, complexity and the *expressive* elements lose value or even go unnoticed. The gothic cathedrals and temples are wildly popular destinations for all types of travelers and architecture admirers. The Unité d'Habitation is not casually venerated for its innovation. The Mahler Symphony is not typically cherished and admired in the context of contemporary culture.

Radoslav Zuk insists that it is the nature of a great work to not be immediately fully accessible (Zuk, 1983, 5). This begs the questions, then, to whom is this work considered great? It is imperative that we ask this question because if a work of architecture or music lies beyond the understanding of an individual or society, and is only fully accessible by its creators and an elite group, then, we can understand the work as a failure (Murray, 1956, 100).

If it is true that a highly *sensuous* piece of music or architecture that has little complexity is as important and valuable as a highly complex and *expressive* piece, then why is there such an emphasis placed on creating deeply meaningful and complex works of architecture in the academic and the professional setting? Why is it professionally unacceptable to design a *sensuous* and appetizing building that is not grounded in meaning or logic? Furthermore, why is it then perfectly normal that the music industry today flourishes on a basis of often purely *sensuous* concoctions? The answers to these questions are clear. Buildings are commissioned by individuals or groups that have needs and desires that must be satisfied by the design. Music on the other hand, is not composed to fulfill a concrete, physical need. Often times, music may be composed *purely* to delight, touch, or move listeners. This is almost never the case for a building. In addition, buildings are costly, and require extensive planning, cooperation and time. A building is a massive physical object that has a permanence and presence in its site. Music on the other hand is ethereal. It may be commissioned or planned, but it also may be created on a whim for any reason at all. If it is unsuccessful it can instantly vanish. It does not have to carry with it the weight of a client's expectation, a budget, an acceptable style, a timeline.

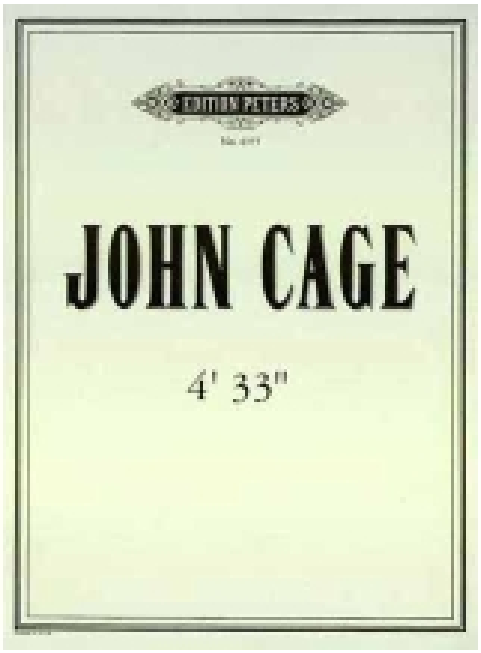
Music is freer than architecture to chase any whim or fancy. Music is more spontaneous. In this way, architects can learn from music; even while budget, timeline, and logistics are innate to the nature of architecture, it would behoove the architect to taste, admire, and be inspired by the spontaneous, light, detached, free qualities that bring music to life.

After the above explorations, we can now begin to see the densely layered parallels that exist between architecture and music, and we have also now glimpsed some moments where architects can look to music for inspiration and liberation. In this next section, we will explore another angle: performance spaces. These are the naturally occurring and most tangible examples of unions of music and architecture.

e) Sound & Music, Acoustics & Psychoacoustics, and Performance Spaces

i. Defining Architecture and Music: Space = Architecture as Sound = Music?

What is the difference between music and sound? What is the difference between architecture and space? These questions do not have one objective answer, much in the same way that there does not exist one ultimate universal answer to the question 'what is art?' Nevertheless, in the context of exploring the relationships between music and architecture, a useful definition of music is *intentionally organized sound*. Regardless of whether this organization follows the traditional rules of music theory, music is sound that is planned and/or organized based around a certain set of pre-determined rules or intended outcomes. For example, the avant-garde composer John Cage composed numerous pieces that critique our typical assumption of music. One of his most well-known works entitled *Four Minutes Thirty Three Seconds*, composed for full orchestra, directs as follows:



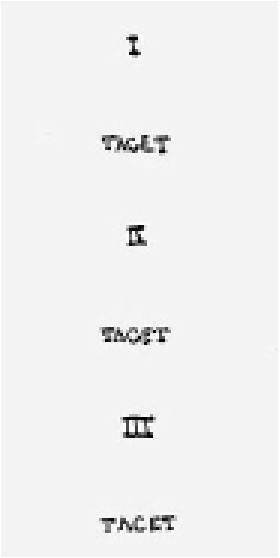


Figure 10. Cover page and score of John Cage's *4'33"*
Image from: http://www.livingworld.net

The term *tacet* indicates to the musician not to play. Typically tacet is used in specific sections of a composition where the particular instrument is not needed. In Cage's masterpiece, the entire orchestra is instructed to tacet for the entirety of the piece. The intention of this piece is to throw into question the definition of music. This piece forces the audience members to gain heightened awareness of the ambient sounds that will fill the concert hall during the four minutes and thirty-three seconds. It is this intentionality to experience ambient sound that allows this piece to qualify as a piece of music according to our definition of music as sound that is organized to produce an intentional outcome.

In this same vein, in this exploration of music and architecture, it is useful to define architecture as *intentionally organized space.* In the spirit of John Cage, we can

imagine scenarios in which a space may not be enclosed, it may not be a building, but it is carefully designed to produce a specific intended effect, that has the power to increase an individual's awareness of a certain spatial condition.

ii. Learning from performance spaces: Acoustics versus psychoacoustics

The phenomenological nature of music allows us to understand that each individual's experience of a piece of music is different. First, on a most tangible level, the mode of delivery of the music to the listener will drastically impact how the piece is perceived. Is the individual watching the performance live in a concert hall? Or is the individual listening at home through speakers? In addition, what are the acoustics of the space? Do they allow the sounds to blossom and expand or do they oppose the natural momentum of the music? These physical scenarios are one of the sets of parameters that impact how an individual will perceive the piece.

The second set of parameters that impact how an individual will perceive a piece is psychological. Acoustics and hearing aside, the physical quality of a space impacts the experience of a piece of music. Is the performance in a historic, ornate performance hall? Is it in a bland high school gymnasium? Is it in a small bar, secretly tucked away with dim lights and a tightly packed crowd? The nature of the space, both architectural and circumstantial, will contribute greatly to how an individual will perceive a piece of music. This effect is referred to as *psychoacoustics.*

Throughout the evolution of classical music, the evolution of concert hall architectural style evolved in tandem. However, as the buildings endured, and the musical styles changed, disconnects became apparent between the musical works, and the spaces in which they were being performed. Today, experiencing a performance of a

modern composition, or even a composition from the romantic era, within a historic baroque concert hall is quite different from experiencing the same piece in a modern concert hall.

For classical music performance, as well as theatre and dance performance, a wave of modernists believed that performance spaces should be *neutral*, devoid of any symbolism or character that will influence the performance (Wiles, 2003). On the opposite end of the spectrum, some performance producers and directors create extremely site-specific works, where the setting plays an integral role in the perception of the overall work. The question of which of these options is superior is not possible to answer, since each gives rise to a different type of experience that can be positive or negative depending on the specific situation. Nevertheless, it is imperative that one is aware of the power of psychoacoustics when thinking about the experiential nature of both architecture and music. (See case studies in section **III**, **a**.)

At present day, as we grapple with issues of existing buildings that are no longer suitable to our current needs, it is important to think about flexibility and adaptability in performance spaces. How can we create spaces that can not only accommodate a wide variety of performance genres, but also transform to fill other programmatic needs when performances are not in session? And furthermore, how can we create performance spaces that will adapt to future needs that may not be fully anticipated at the time of design and construction? To answer this question we can look to the theories of Stuart Brand, in his book *How Buildings Learn*. In essence, Brand identifies ranks elements of a building from most permanent (site) to most changeable/flexible (finishes) (Brand, 1995). For a performance space, the most permanent is the auditorium or building itself, while

the most changeable should be the configuration of audience inhabitation and performer staging.

iii. Composer-Performer-Audience Relationship

The experience of a piece of music is not based on a single and absolute existence of the work; rather, it is sculpted in large part by the relationship and interaction between the composer, the work itself, the performer, and the receiver. In this same way, the experience of a piece of architecture is based on the relationship between the architect, the work itself, the builders, and the occupants. In both music and architecture, the relationship between the architect and the builder, and the composer and the performer is defined by systems of notation, as discussed in previous sections. In this way, we can think of the architect as the composer, and the builder as the performer: the entity that brings the work into the world so that it may be experienced by occupants.

However, a more provocative analogy is to understand the architect *and* the builder as the composer, and the erected building as the performer. Following this logic of building as performer, we can compare the complex relationship of a musical performer and a musical receiver to the relationship between building and occupant. By studying the relationship between musical performer and receiver, and then applying these relationships to our understanding of how buildings interact with their inhabitants, we can gain a fresh and dynamic vision of this relationship and how it can be manipulated. First, we explore the relationship between musical performer and observer.

Typically, at a musical performance, the performers are the musicians on stage who are producing the music that the audience, or the observers, who are seated facing

the stage, will watch and hear. This definition of performer and observer is in line with the classical Cartesian view of spaces as distinct, separate containers (Wiles, 2003).

However, the understanding of performer and audience as two entirely separate and distinct entities is limiting. For example, one can argue that during a performance both the audience and the performers are the performers, and both the audience and the performers are the performers. In fact, the spatial arrangement of the auditorium plays a large role in defining the relationship and interaction between the performers and the audience. (Further discussion of this topic in **II**, **a**, **iii**, Berlin Philharmonie case study.)

iv. Experiencing a performance

When one attends a performance, the experience of the performance is not bounded by the start time and the finish time of the music. Rather, the experience of the performance begins with the anticipation and the events leading up to the main event. Travel to the venue, arrival, entrance to the building, meeting fellow concertgoers and friends, exploring the common spaces, obtaining tickets, navigating to the auditorium, finding one's seat, and the final moments before the lights dim are all elements of the experience and will sculpt one's perception of the event and the psychoacoustics.

When thinking about architecture, it is interesting to note how the concert hall is an exciting space, regardless of the architecture itself, due to the programmatic elements and activities that it encompasses. In this way, by adding certain programmatic elements to an otherwise uninteresting building, the building immediately takes on a different identity and gives occupants and observers a different perception.

CHAPTER II

CASE STUDIES

Precedent works in architecture that engage with the domain of music do so though a variety of strategies. The following examples in part **a** illustrate these varying approaches. Part **b** contains additional strategies investigated through original work.

a) Architecture Works

i. Stretto House

Steven Holl's *Stretto House*, built in Texas in 1991, was based on a Béla Bartók's composition *Music for Strings, Percussion and Celesta.* This is an example of direct translation of a specific musical concept into build form.

The musical term *stretto* is used to describe staggered and overlapping entrances of several voices, each commencing with the same motif. Immediately evident is the spatial translation of *stretto* in the elevation of this structure:

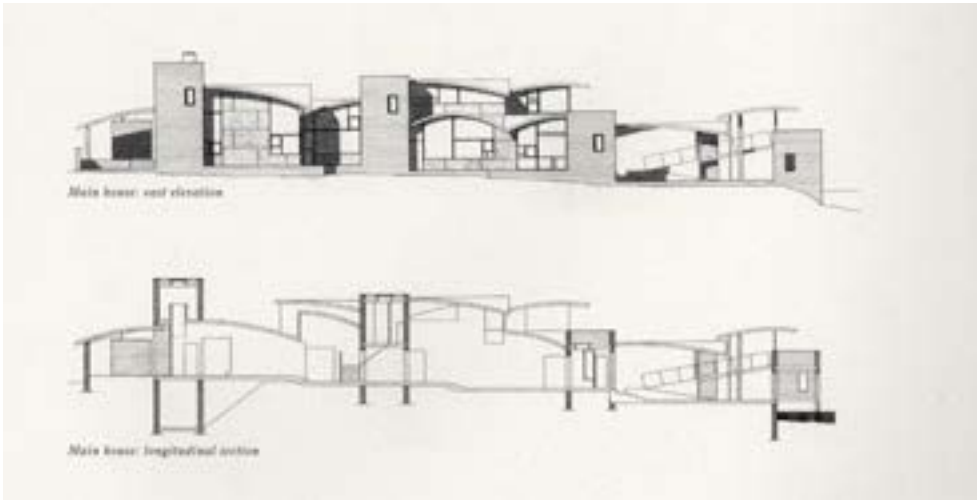


Figure 11. Elevation and section of Steven Holl's *Stretto House*
Image from: http://www.stevenholl.com

In addition, Bartók orchestrated this piece to create juxtaposition between the light, flowing, airy timbre of the strings, versus the heavy, grounded, solid quality of

sound from the percussion instruments. This musical arrangement is also clearly and directly translated into the building language, with heavy masonry masses interrupting an elegant flow of curving metal roofs and delicate glass facades (Martin, 1994, 56).

ii. Sainte-Marie de la Tourette - Undulating Glass

The undulating glass was conceived of and designed by architect and composer Iannis Xenakis (more about Xenakis in section **iv**) under the supervision of Le Corbusier. The variation in the spacing of the mullions and the sizes of the glass panels creates a rhythmic flow that dances across the façade. This is much akin to the musical strategy of sub-dividing primary beats to arrive at a rhythmic gesture that breaks away from repetition, creating movement and variation.

Figure 12. Iannis Xenakis' *Undulating glass* in Le Corbusier's *Sainte-Marie de la Tourette*
Image from: https://knoji.com

iii. Berlin Philharmonie

Architect: Hans Scharoun
Acoustic consultant: Lothar Cremer with Joachim Nutsch
Completion: 1963
Seating capacity: 2,218
'Nickname: "Circus Karajani"

It would be unjust to closely examine and admire the architectural strategies employed in the Berlin Philharmonie Concert Hall without first recognizing its intense social, political, and geographical location.

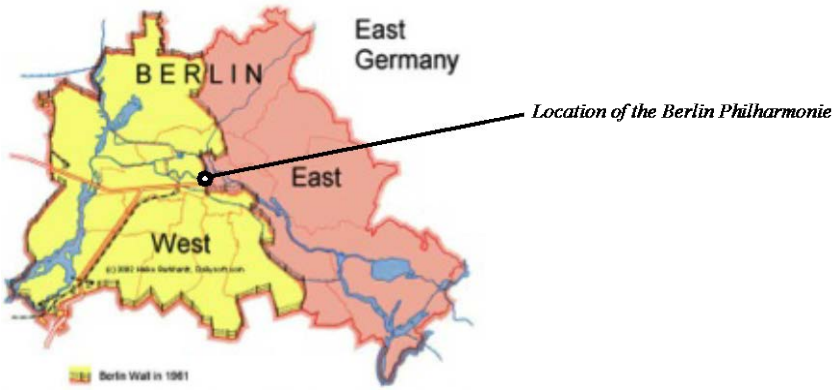


Figure 13. Map of location of *Berlin Philharmonie* between West and East Berlin
Image from: http://www.citiesgallery.com
Annotations by author

The Berlin Philharmonie was constructed just two years after the erection of the Berlin Wall, and it was sited in the most eastern part of West Berlin, just adjacent to the divide. The hall's dynamic silhouette established a presence, both visual and political, on both sides of the wall, which was significant because this building was intended to create a progressively-minded, participatory experience, that melds "man, space [and], music" (Campbell, 2007). This context is of great importance, because, just like architecture, the performing arts are creations that both arise from and redefine their social, political, spatial, and temporal situations.

Far too often, the performing arts are misunderstood as autonomous events that exist in a vacuum and are simply performed to entertain an audience. This is an insufficient understanding because it ignores the strong engagements with the socio-political environments in which works are created and instanced, and the ideas that the works can transmit to a people. In the case of the Berlin Philharmonie, the architecture was created to give rise to types of experiences that mirrored the social and political envisionings of German progressives during the 1960's. (The nature of the experience of attending a concert here is described in next section.)

Looking past the aggressively charged context in which was built, the Berlin Philharmonie is exceptional from a purely architectural and experiential perspective. It is an important point of study for this thesis not because it is a music performance venue, but because of the musicality of its architecture. In other words, this building accomplishes a complex and powerful translation of deep-rooted musical strategies into built from.

From the exterior of the hall, the tectonics do not permit an immediate understanding of the spatial configuration within. The hall is not bound by distinct facades that delineate space; rather, the envelope is a patchwork of forms and masses that require visitors to inhabit and experience the interior spaces in order to begin to understand the building.

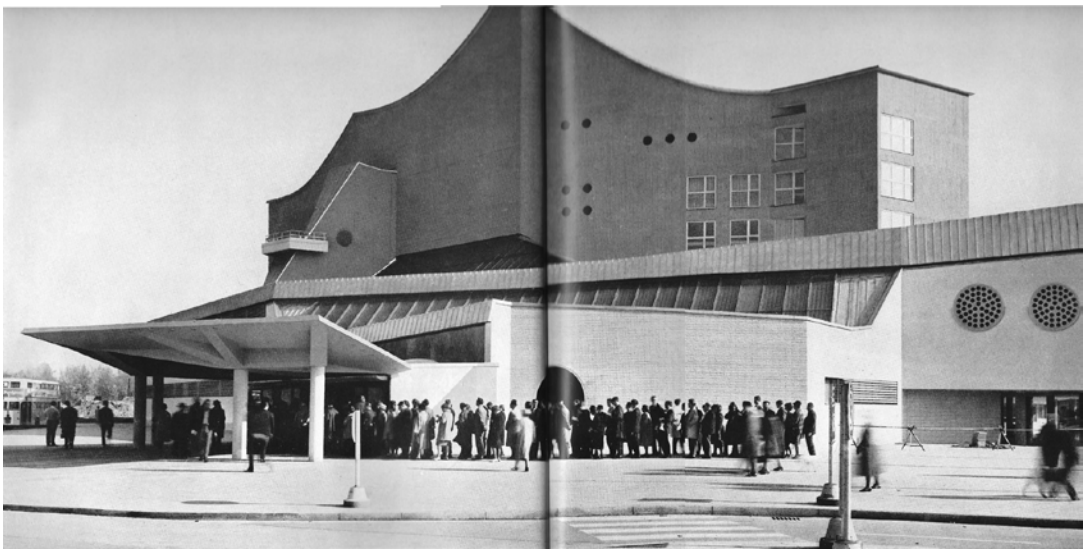


Figure 14. Hans Sharoun's *Berlin Philharmonie*, exterior
Image from: Conrads (1964), *Berlin Philharmonie.*

Even after one enters, the interior is not immediately defined by a direct, formal, strict order. Rather, it is a kaleidoscopic interplay between stairs, terraces, bridges, volumes and views that unwinds as one moves through the spaces. This is the most accurate understanding of the space that one can attain, rather than attempting to understand the hall as an arrangement of discreet spaces.

Figure 15. *Berlin Philharmonie*, interior lobby
Image from: Conrads (1964), *Berlin Philharmonie.*

This has profound implications. First, it is in direct contrast to the Kantian understanding of space, which registers spaces as defined, fixed containers. Sharoun stuck down this notion by creating paralactical spaces that are continuously redefined as one moves through them. One important implication of this technique is that it bares rigid and formal circulation, instead giving rise to a varied, fluid, creative, inspiring experience for concertgoers as they arrive and mingle before the main spectacle, as well as during post-concert socializing and reflecting.

Figure 16. *Berlin Philharmonie*, interior circulation
Image from: Conrads (1964), *Berlin Philharmonie.*

This approach is important and fascinating because, as discussed previously, the performing arts are not rigid events in space-time that have specific beginnings and ends. The concert begins at 7 and will last two hours. This is highly inaccurate, because one's

experience at a performance is strongly shaped by the time and space that is encountered before and after the main attraction. Anticipation of a concert, travel, arrival, waiting in line, movement through the lobby and corridors, navigation to one's seat: these are integral parts of a performance, and will strongly influence the audience's perception of the main show.

According to Conrads,"[w]hat a difference from the conventional theatre promenades in whose horseshoe shape the audience must circulate like prisoners at exercise! But here the experience of music remains alive, it echoes forth in the listener's mind (Conrads, 1964)."

The fluid, boundless circulation that the architecture allows before and after the main concert reflected a new direction in performance and audience involvement; it was unlike any other at the time. In addition it begins to reveal the powerful role of architecture in shaping performance experience.

It is important to note that the shifting, playful, complex architectonics of the Berlin Philharmonie also recalls the organization of a musical composition. In the words of Scharoun, "It is my idea to make something visible by articulating." This is interesting because using the verb articulating in lieu of the noun articulation, the architect is referring to the ingredient of time that is essential to experiencing this concert hall. Moving through the hall creates relationships, atmospheres, views, moments, that swirl, shift, weave and interact just like melodies, harmonies, rhythms, and tones interplay in music through time.

Figure 17. *Berlin Philharmonie*, interior circulation
Image from: Conrads (1964), *Berlin Philharmonie.*

Czech writer and journalist Joseph Wechsberg described the experience of attending a concert at the Berlin Philharmonie: "[a]ll in all, the room will not be a place to relax in, and Professor Scharoun doesn't want it to be; he feels that people get lazy in ordinary halls. Here they will be stimulated to cooperate mentally with the musicians (Campbell, 2003,160)."

In the various performing arts, one can discuss the concept of audience participation, or performer-observer interaction. The level of interaction is often assumed to be higher in popular music concerts, where the audience may sing or chant, or even cross onto the stage. On first glance, audience participation in classical music concerts seems non-existent-- it would seem that there are two groups: performers and observers This is inaccurate. There is much possibility for audience participation, though it is a

more nuanced interaction. In a classical music performance hall, performer-observer interaction is determined by the configuration of the stage and the seating, as well as the lighting and acoustics, which all contribute to an ambiance.

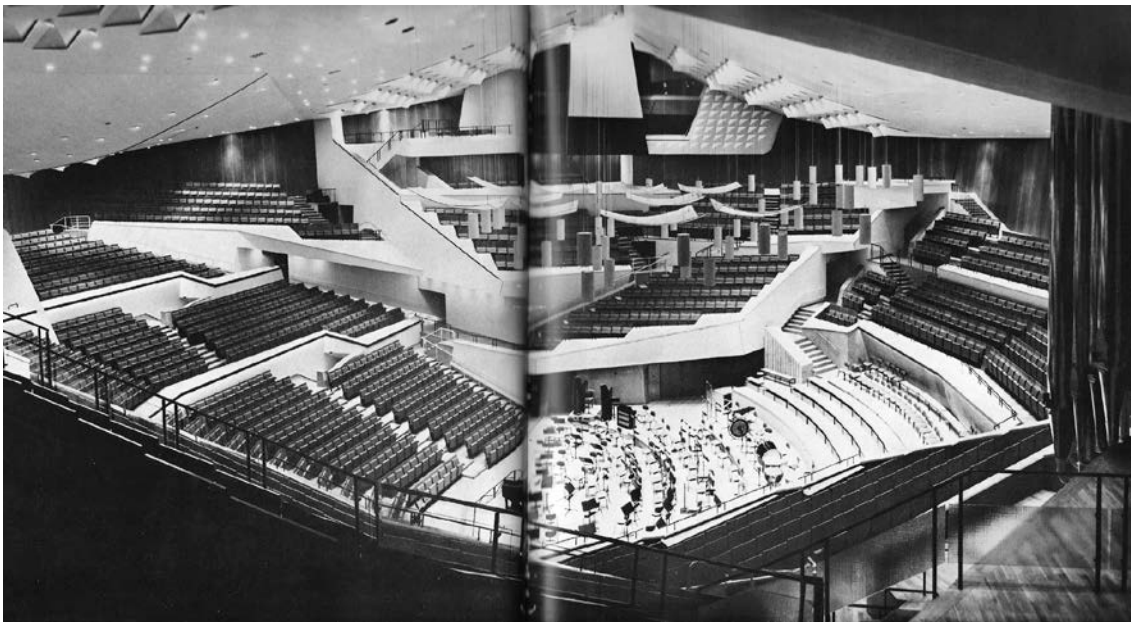


Figure 18. *Berlin Philharmonie*, main auditorium
Image from: Conrads (1964), *Berlin Philharmonie.*

In the Berlin Philharmonie, the auditorium is essentially configured in arena style, meaning that there is seating on all sides of the stage. This organization was central to Scharoun's vision of "[m]usic in the center!" (Beranek, 2004, 297). The result is a more intimate experience (a fluid exchange across audience and musicians!) than a traditional proscenium stage, where the audience is seated in rows in front of the stage, with a picture frame-like opening, the proscenium arch, defining the boundary between observer and observed.

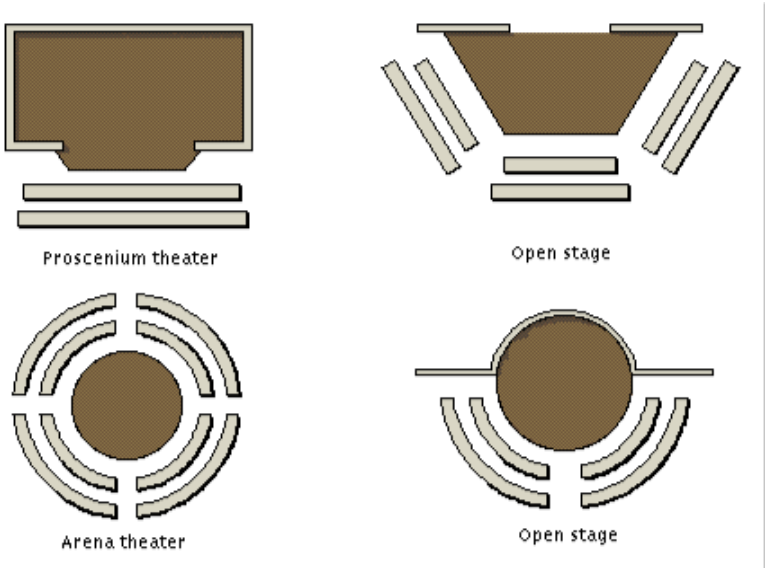


Figure 19. Typical auditorium configurations
Image from: http://www.filmplus.org/03/arena.gif

The Berlin Philharmonie auditorium configuration departs from the standard arena configuration through the use of ascending terraces and platforms that dance playfully yet dramatically around the stage, breaking up the mass of seats. Hans Schroun referred to these as “vineyards,” forming a landscape of valleys for experiencing the music below (Conrads, 1964). There is no hierarchical rank in seating; instead it is about personal preference or curiosity, and one may meander across the interconnected vineyards to arrive down at the level of the orchestra.

The wrapping of audience around musicians contributes to an ambiance of inclusion and honesty. There is no curtain blatantly concealing the mechanics of a back-stage. Instead there is a sense of equality and continuity between the performers and the audience; the performers are not portrayed as non-human beings that emerge from a hidden back-stage, create a performance, and then vanish again.

The spatial arrangement and geometries of the auditorium seating are so wild that one almost does not notice. On close observation, the space is even symmetrical. Also,

compared to concert halls of similar scale, the Berlin Philharmonie is fairly modest, with no elaborate architectural elements or artifacts that suggest hierarchy or exclusivity.

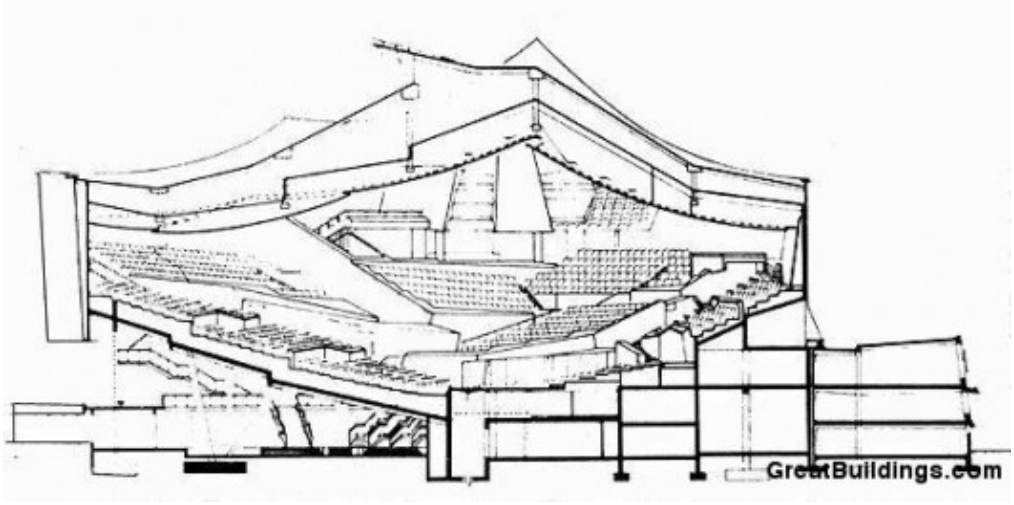


Figure 20. Berlin Philharmonie, main auditorium section
Image from: greatbuildings.com

Today, in a time when the performing arts continue to evolve, it is important to consider the flexibility of a space. How well can it adapts to different types of performances? The Berlin Philharmonie is not a fully flexible performance space. It is perfectly suited to orchestral performances, accommodating up to 120 musicians. Today it is also used for smaller musical ensemble performances, including jazz and contemporary, as well as some dance, and educational programs. It would not be especially conducive to other types of performing arts, and may even be restrictive since it was designed specifically for the modern classical orchestra.

iv. Philips Pavillion

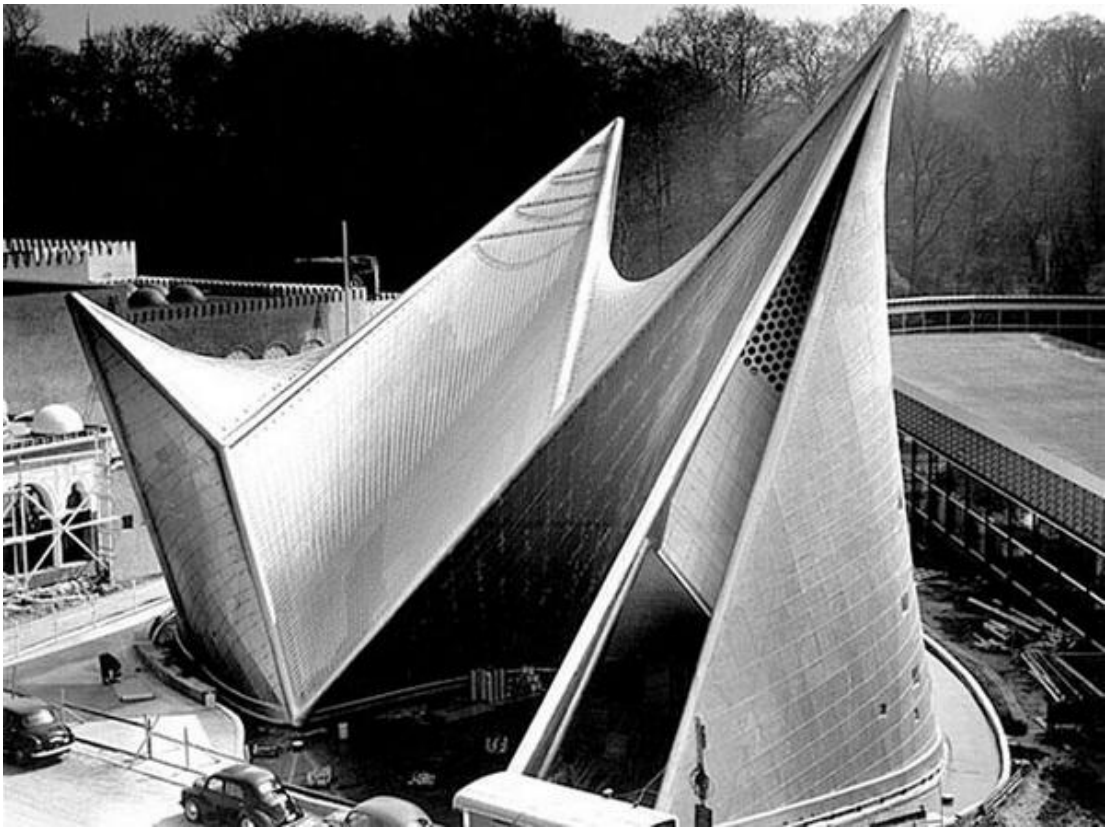


Figure 21. Iannis Xenakis and Le Corbusier's Philips Pavilion, exterior
Image from: http://www.designbuild-network.com

Project architect: Iannis Xenakis, Office of LeCorbusier
Completion: 1958
Location: World's Fair, Brussels
Collaborators: Architecture: Iannis Xenakis, Video imagery: LeCorbuser, music: Edgard Varèse

Iannis Xenakis, born in Greece, spent much of his life and career in France. He was originally trained as a civil engineer, before going on to study music composition, and later working as an architect in the studio of LeCorbusier. Xenakis is considered one of the most influential figures in the development of electronic music. In the words of writer Alan Licht, "[Xenakis] took the spatial and interdisciplinary implications of a modern concept of music - as sound moving through space - to their apex." (Licht, 2010).

To do so, Xenakis drew upon his study and practice of mathematics, architecture, and musical composition, combining them in unprecedented ways.

These are different than graphic scores because they are based on mathematics:

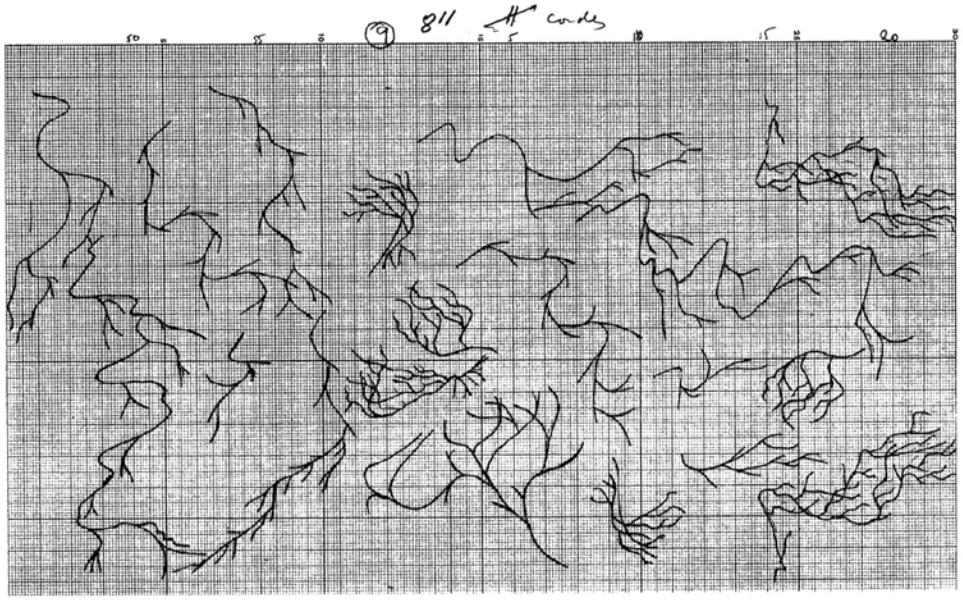


Figure 22. Excerpt from score of Xenakis' composition, Arborescences
Image from: http://www.olats.org/pionniers/pp/xenakis/xenakis_exemple8.php

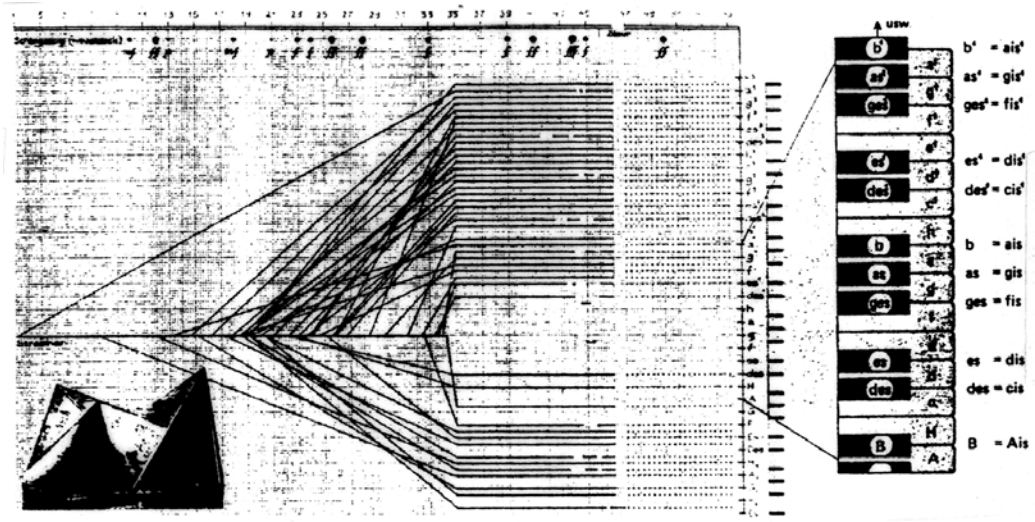


Figure 23. Excerpt from score of Xenakis' composition, *Metastasis*
Image from: http://grekamag.gr/55024/

The Philips Corporation commissioned LeCorbusier to design a pavilion to showcase their technological advances in audio and visual electronics. Instead of a pavilion simply containing their products, Philips envisioned a collaboration between architects, artists and musicians, to create a work that would engage with all of their latest technologies. LeCorbusier agreed to take on the project, and insisted on engaging the composer Edgard Varèse, who, along with Xenakis, was one of the avant-garde pioneers of electronic music. For the project, Varèse composed Poème Electronique, which remains an important part of the early electronic music repertoire (even though it is not commonly associated with the pavilion). To accompany the music, LeCorbusier created a video-montage depicting the evolution of western civilization.

At the time, LeCorbusier was largely engulfed in his Chandigarh project, so he put Xenakis in charge of the architectural design, with his only real direction being, "Mettez-moi un peu de maths là-dedans," meaning "just give me a little math in there." LeCorbusier later took credit for this highly innovative design based on hyperbolic forms.

Figure 24. *LeCorbusier with Varèse and Philips art director Louis Kalff*
Image from: http://www.music.columbia.edu

Xenakis' mathematical calculations, musical compositions, and architectural designs all fed off of each other, and the hyperbolic forms of the Philips Pavilion were actually based off of the mathematics that he used to create and depict one of his most important musical compositions, Metastasis, composed in 1955.

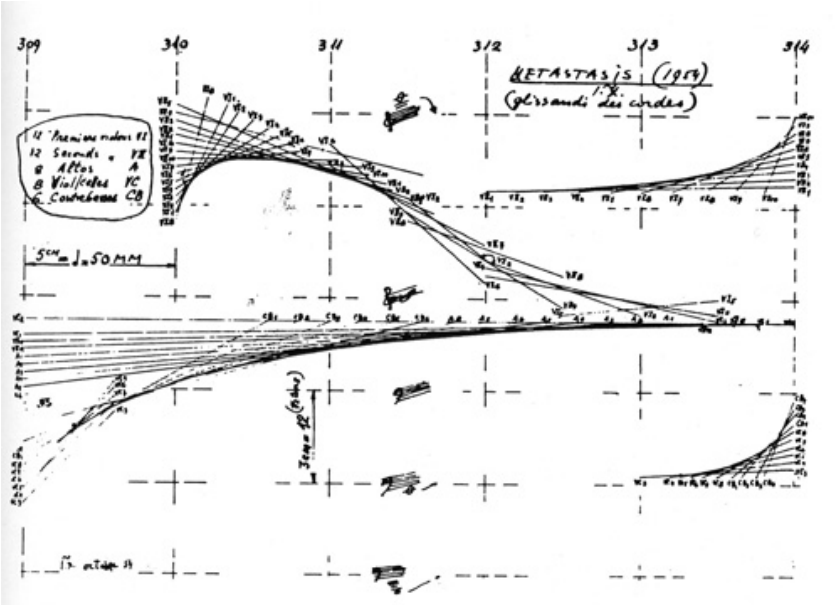


Figure 25. Excerpt from score of Xenakis' composition, *Metastasis*
Hyperbolic forms inspired Philips Pavilion design.
Image from: http://greg.org/archive/2009/05/03/this_poeme_electronique_was_brought_to_you_by_philips.html

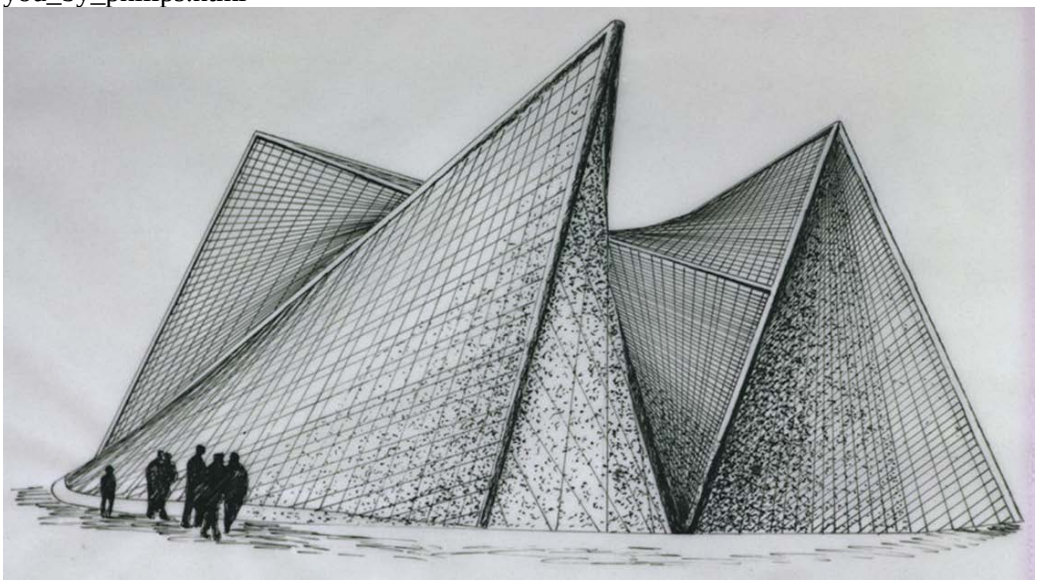


Figure 26. *Philips Pavilion*, sketch of exterior by Xenakis
Hyperbolic forms resemble score above.
Image from: http://www.iannis-xenakis.org/xen/archi/real.html

What is important here, is that form is inspired by mathematics and notation, not determined by acoustical calculations. However, the hyperbolic surfaces, combined with the electroacoustic spatiality of the Poème Electronique gave rise to surreal acoustic and sensory experience for visitors. In addition, the form contributes to the experience because it alters the visitors' perception of what they are experiencing. In other words, the form sculpts the experience because it contributes to the ambiance of the music, sound, light, and image.

b) My Experiments

As preludes to the final design portion of this thesis, I first completed three smaller scale experiments, which each engaged a different element of this exploration of the relationships between music and architecture.

i. University of Massachusetts Summer Design Academy Experiment

I have had the opportunity to spend two summers assistant teaching the University of Massachusetts Summer Design Academy, which is an intensive academic program for high school students that are interested in pursuing architecture or design in college. At the beginning of the program, as an introductory exercise, we played a 15-second excerpt of a traditional African drumming song, and asked the students to translate the sound to the visual, and draft it on paper with markers. Eventually, we charged the students to translate this two-dimensional drawing into a three-dimensional canopy made of colored papers and string, to shade the windows in the studio.

Initially, the students were surprised and even confused by the idea of drawing sound. Yet, what was most fascinating was that as soon as we played the clip, all of the

students immediately, almost instinctually, drew the music. The drawings varied greatly from student to student, yet each was able to clearly describe how it was a translation of what they heard.

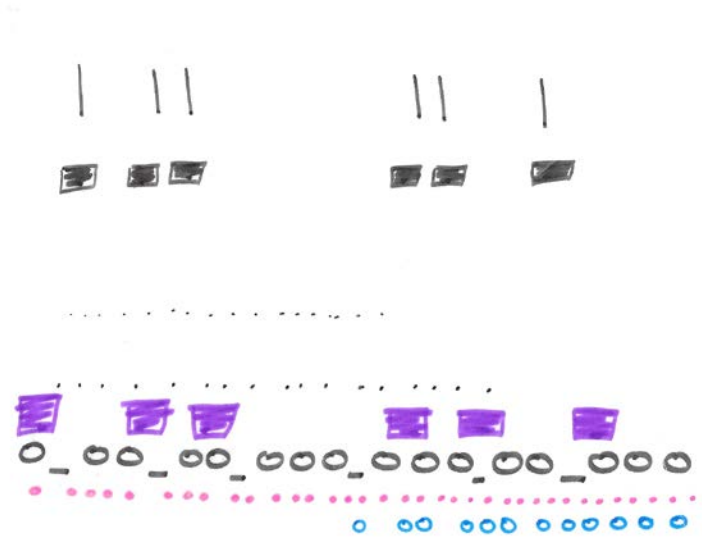


Figure 27. Student sketch, Summer Design Academy, Summer 2014

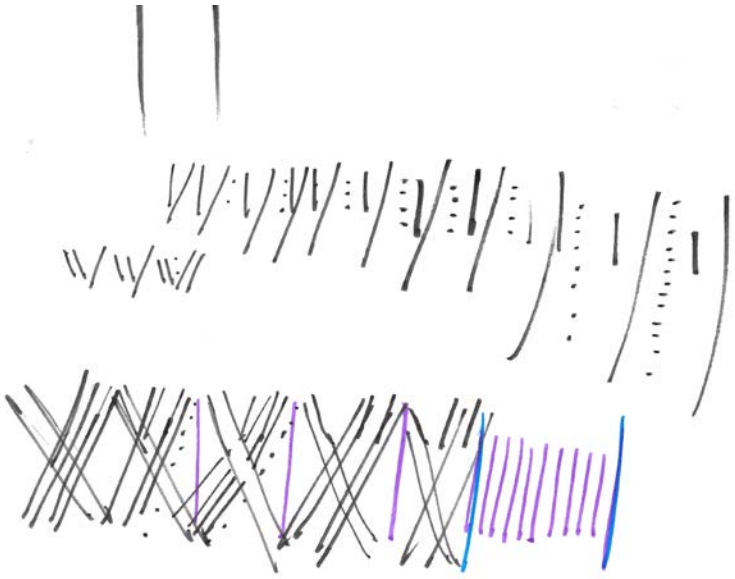


Figure 28. Student sketch, Summer Design Academy, Summer 2014

This experiment shed light on the strength of the relationship between music and spatial/visual form. I saw each student, with little to no instruction, immediately express music spatially by instinct alone. This confirmed to me that this is a relationship that is relatable and can be meaningful to any individual.

ii. Suspention Studio Project

For the second experiment, I designed and crafted a suspended sculpture based on composer Frédéric Chopin's Prélude No. 9 in E Major for piano. The sculpture is a spatial translation of the primary musical gesture in the piece. In order to distill this gesture and to translate it to the physical, I first conducted a careful analysis of the piece using two approaches: first, a traditional roman numeral analysis (classical music theory), and second, using a software program called sonic visualizer. The first strategy led me to understand the structure of the piece; where and how the sections are arranged and how each section progresses to the next. The second strategy allowed me to quantify the contributions of the performer, who pushes and pulls the beats to create expression and bring the written musical gesture to life. The software also allowed me to quantify the occurrence and concentration of the range of pitches.

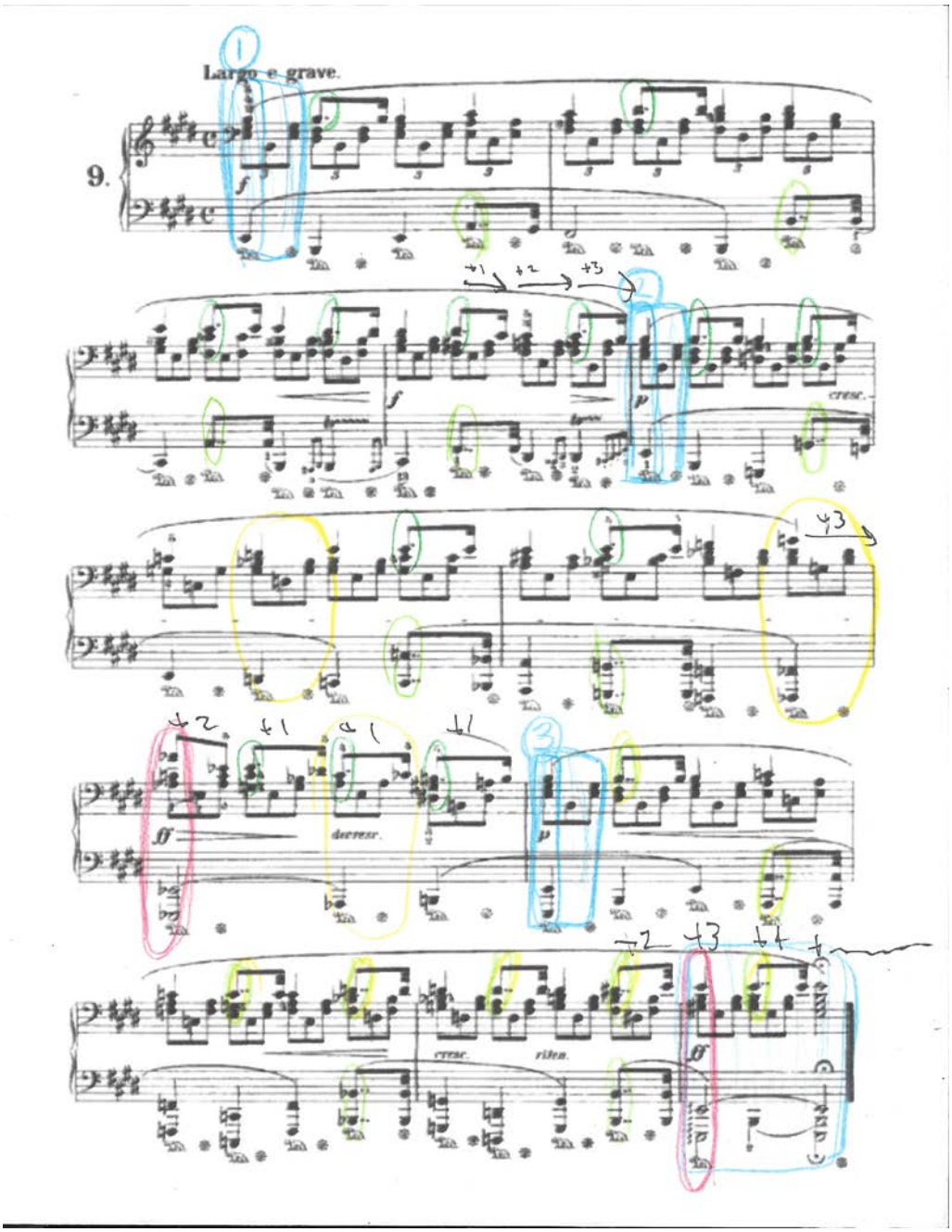


Figure 29. Score of Frédéric Chopin's *Prélude No. 9 in E Major* with annotations Annotations by author depict analysis of major moves in composition.

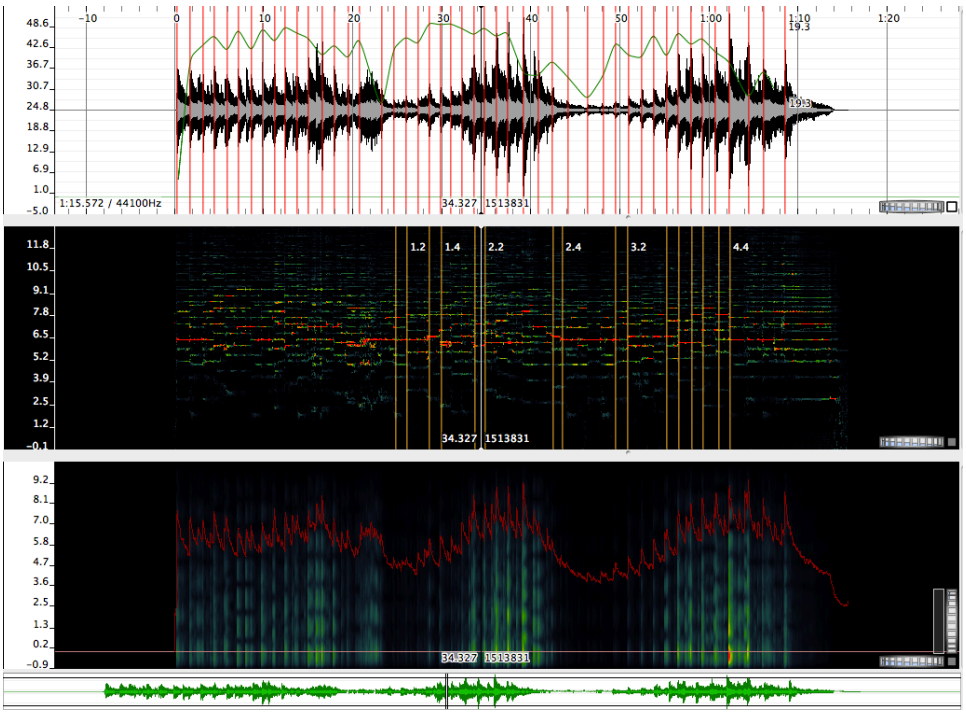


Figure 30. Screenshot of *Sonic Visualizer* analysis of *Prélude No. 9*
Image by author

After these analyses, I identified the primary constitutive gesture of this piece to be a distinctive swell followed by release, which is overlaid on a beat divided into three parts. Furthermore, it is comprised of three sections, with each section composed of the same swell and release in both pitch range and intensity. Finally, the piece as a whole, over the three sections, is a swell and release, as the piece comes to a climax and then releases to a resolution. After listening to the piece hundreds of times, I intuited a shape that captures the aural swell and release in this particular piece, and then multiplied and transformed the shape to capture the gesture in the piece, ultimately suspending the shapes in three-dimensional space.

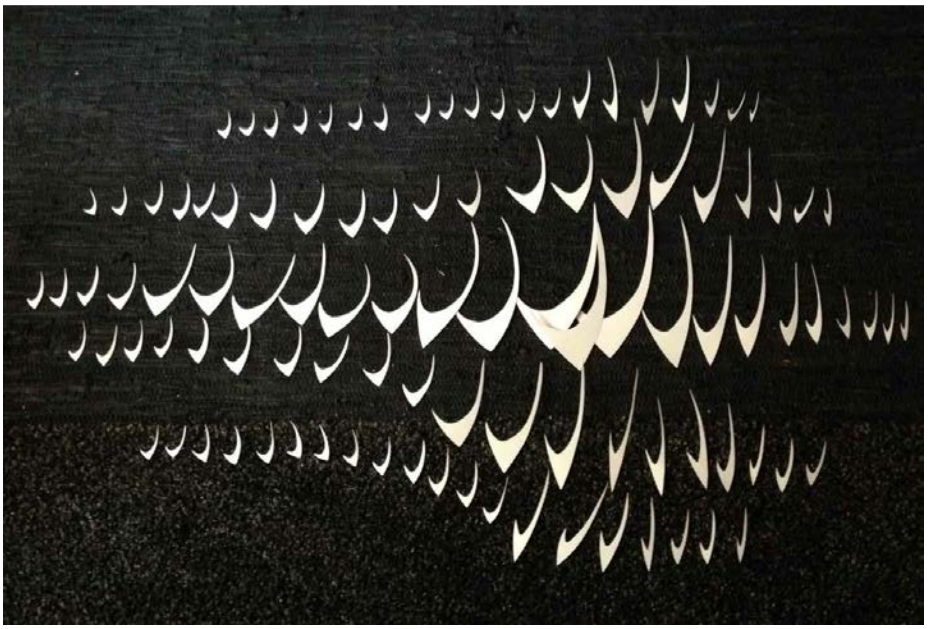


Figure 31. Photo of shapes before suspension
Image by author

Figure 32. Photo of final suspended sculpture
Image by author

This was an incredibly enlightening exercise, because I realized how much information is contained in even this small scale composition (under two minutes long, solo piano). I came to the realization that in order to use musical concepts as inspiration for spatial forms/strategies, it is necessary to be specific and selective. In other words, it

would be impractical to take a full-scale symphony and attempt to translate every aspect of the music into a form; instead it is necessary to target specific elements of the piece.

In addition, I also grappled with the overwhelming association of time with horizontal or vertical sequential movement. Why do we naturally associate time with a horizontal axis? It is much more powerful to think about the translation of a temporal musical gesture as a simultaneous spatial phenomenon. What would a symphony look like if the entirety of the piece were visualized simultaneously?

iii. Stair Studio Project

The final experiment was part of a studio design project, in which we were to envision the form and details of a custom stair. The most immediate parallel between a stair and a piece of music is the even, regular, incessant rhythm of the treads on a stair and the underlying beat/pulse in a piece of music. In music, this even underlying pulse is the basis from which movement and expression in the melody and harmony may arise. In this same way, for the stair design, I allowed the stringer and eventually the rails to play the role of the melody and harmony that rise and dance across the even pulse of the treads.

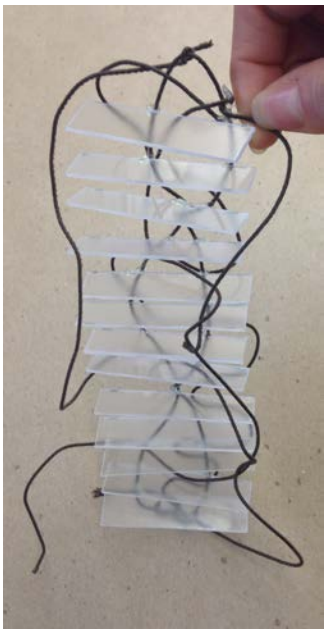


Figure 33. Study model 1
Image by author

Figure 34. Study model 2
Image by author

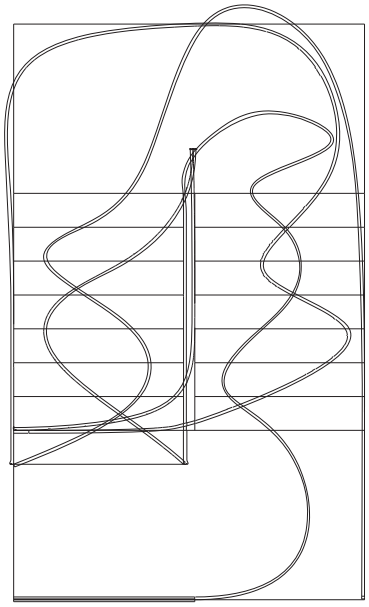


Figure 35. Plan
Image by author

Figure 36. Rendering
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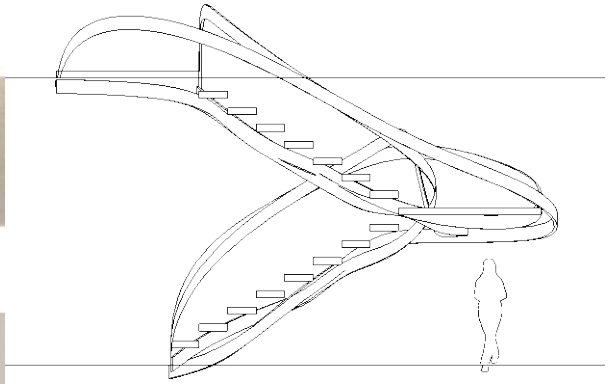


Figure 37. Elevation
Image by author

CHAPTER III

EXISTING SITE & PROGRAM

In order to test the implications of my research in a full-scale building design, I have selected a site at the University of Massachusetts Campus, containing three existing residence halls. I have selected this site for two main reasons: First, having been employed for two years with the Housing Department at the University, I have had the opportunity to study all of the residence halls on campus. This group of three buildings is in great need of an additional communal building on the site. Second, this site has a strong established rhythm and architectural language, which I will use as a basis from which I introduce musical strategies.

a) Sylvan Residential Area

i. Residential Life at the University of Massachusetts

The University of Massachusetts Amherst is one of the largest residential campus in the United States, housing over 15,000 students in 61 residence halls. The halls are arranged in clusters, with each cluster in a unique location on the perimeter of the campus.

ii. Existing Buildings

The site for this project is located at the Sylvan Residential Area, a cluster of three identical residence halls located in the far northeast corner of the University of Massachusetts Amherst campus. The buildings were designed by John Paul Warnecke and Associates, a New York City-based firm, and was constructed in 1971. Each building is comprised of nine stories, and each typical floor plan contains eight suites (64

suites total). Each suite contains five student rooms (some single occupant and some double occupant) as well as a common space and a bathroom. In total, the Sylvan Residential Area houses approximately 1,500 students.

Figure 38. Locus map of University of Massachusetts campus buildings showing location of residence hall areas
Sylvan Area at top right
Image by author

The brick facades of the buildings are faceted, exposing the repeating configuration of the suites. From the exterior, one can immediately understand the repeated stacking arrangements all the way up to the top level. The windows are also repetitive, indicating the location of the rooms. The windows are detailed with angled recesses cut into the brick, setting the openings deep into the façade.

Figure 39. Photos of Sylvan Residential Area
Images by author

iii. Site

The site is bordered on the north and east edges by a natural wooded area. When the buildings were first constructed, they were bordered by woods on the west edge as

well, however this area was cleared two decades later for the construction of a separate area of student apartments. Even so, nature remains an important element of the identity of the Sylvan Area.

Another unique aspect of the site is its dynamic topography. The site is near the bottom of a large hill, and slopes down from the southeast corner to the northwest corner. There is a 30 foot grade change diagonally from the highest corner of the site to the lowest.

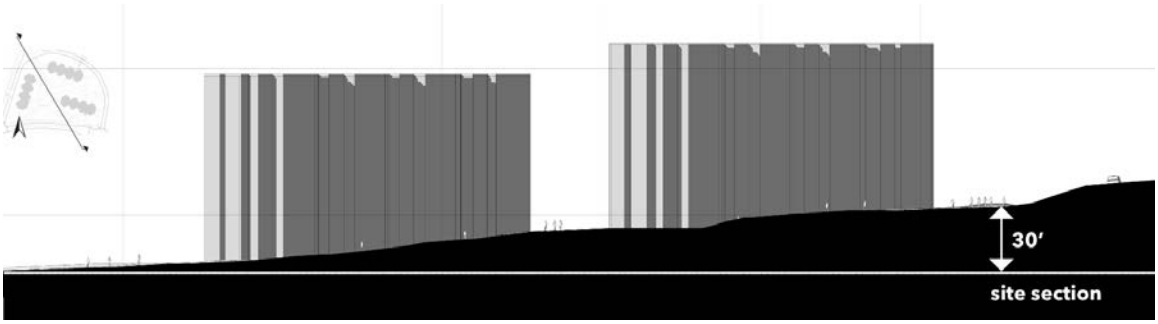


Figure 40. Sylvan Residential Area site section
Image by author

Each building carves into the landform, with one end containing entrances on the second level, and the other end containing entrances on the ground level. The second level entrances consist of one main entrance and one emergency egress point. The ground level entrances consist of one maintenance access point and one emergency egress point.

The three buildings are configured on the site such that there is a large central open space, with a small landscaped area containing a curving seat-height stone wall. Curvilinear paved paths meaner throughout the site, connecting each building to the adjacent building and to the central area.

Figure 41. Photos of Sylvan Residential Area
Images by author

iv. Location issues

The Sylvan Area is located in a far corner of the campus, making it inconvenient for students to access the main library and academic buildings on the other side of the campus. There is, however, a bus stop directly in front of the site, allowing students to access different parts of campus without an extended trek, especially useful during the harsh New England winter. There is a definite need for larger communal spaces that can be used for studying and recreational activities.

Due to the facts that the site is located in a far corner of campus, there are no major communal spaces, and the architectural configuration is not particularly welcoming, the Sylvan Area is not a destination on campus for non-residents. The area would be reinvigorated by the addition of a flexible event space that can accommodate performances, presentations, and other student-run functions. Ideally, the new addition should introduce a materiality and an architectural configuration that is welcoming even to individuals that have never visited the site.

v. Interior

The student rooms are the smallest on campus, and are quite dark. Concrete block partition walls contribute to the uninspiring character of these interior spaces.

Each building contains two small communal lounges, one on the ground level and one on the second level. Like the student rooms, these spaces are small and uninspiring.

CHAPTER IV

DESIGN

In order to revitalize the Sylvan Residential Area, I propose the addition of a communal arts center, where students take classes, study, socialize, hold events, and perform and present their arts. Addition of this central building will transform the Sylvan Residential Area, from a fading periphery, into a sanctuary for the arts and a destination for all students.

Figure 42. Elevations of proposed communal arts building
Image by author

a) Massing from Existing Rhythms and Circulation

Rhythm is the heartbeat of music. It is the incessant, unrelenting force that organizes and drives all of the strands that make up a piece of music. The rhythm within my site is defined by the incessant rectilinearity of the faceted existing building forms and their orthogonal placements. I first experimented with breaking down the central courtyard using the existing buildings as a grid projected horizontally across the site.

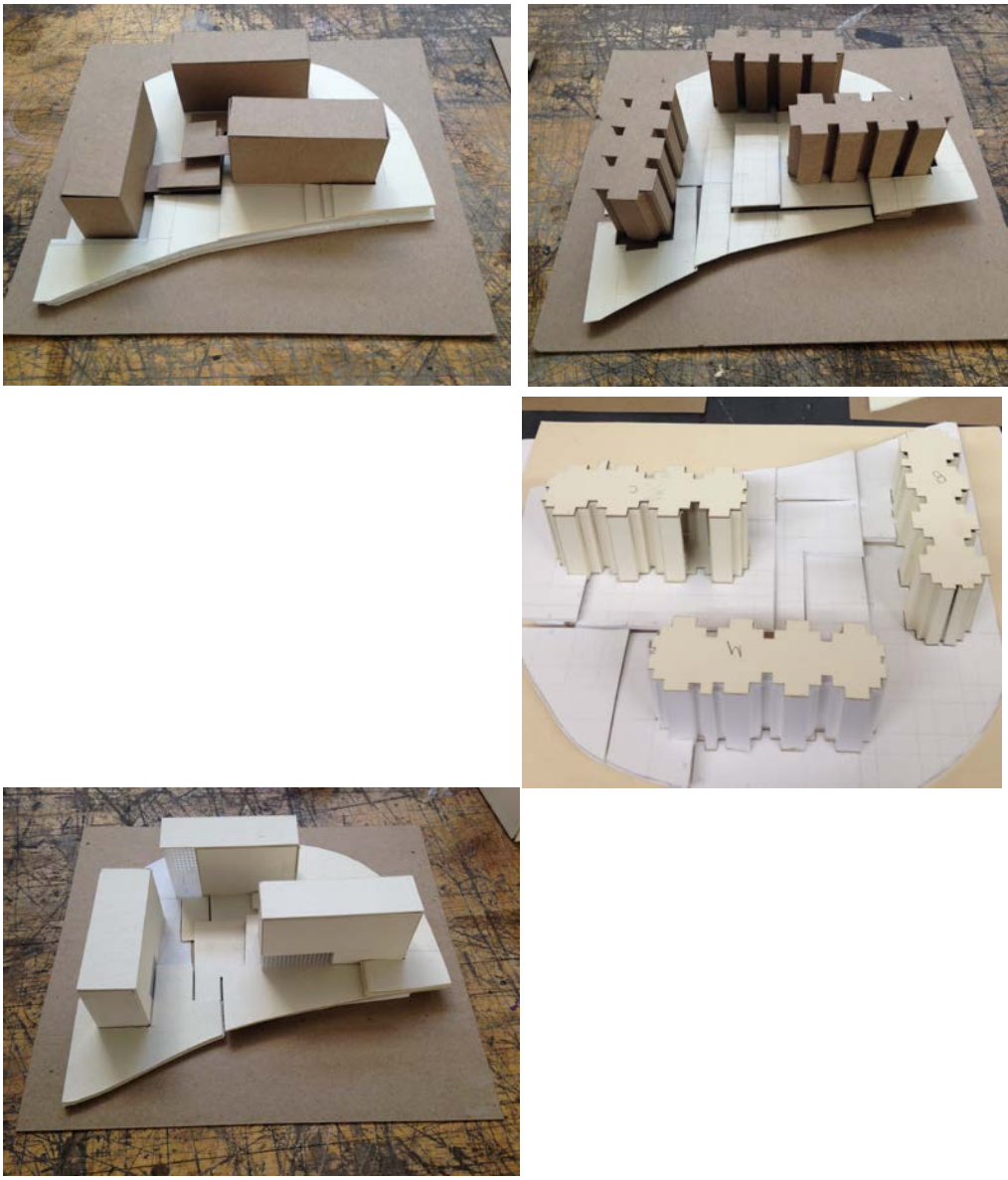


Figure 43. Study models
Images by author

However, music does not obediently follow this precise, repetitive framework; music is flavored by the ways it subdivides the beats and pulls across them. In this way, I allowed these forms to begin to break away from this grid, mimicking the strategy of syncopation in music.

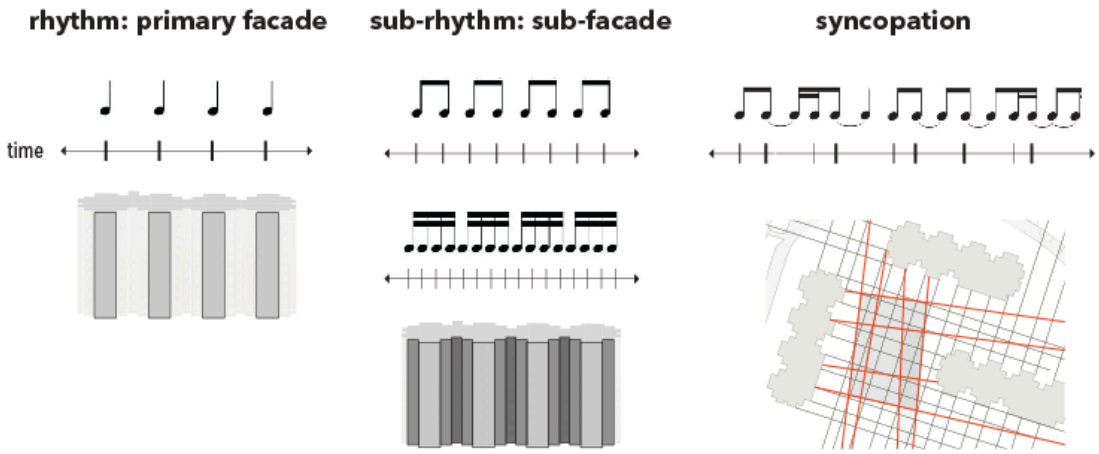


Figure 44. Diagram of translation of musical rhythm into building footprint
Images by author

Next, I applied the strategies of musical melodies to the circulation patterns within the site. One way to compose a piece of music, is to begin teasing out a melody or a rhythm, building on it, morphing it, elaborating on it, and then working the strands to come back together, weaving a full musical gesture. In a parallel way, I studied movement to, from, and within the site, which emanates from six principal strands: residents activate the main entrance of each building (1-3), individuals coming for an event will flow from the large parking lot to the northwest of the site (4), pedestrians coming from campus will come along the sidewalk from the west (5), and individuals will also arrive via the bus stop and the smaller parking lot at the east end of the sidewalk (6). What is most interesting about these six strands of movement, is how they are swept into the third dimension through the grade change of 30 feet. Like composing a piece of

music, I worked these six strands until they began to weave together, up, across, and down, crystallizing the syncopated geometries established by the existing building forms on the site, defining a dynamic spatial gesture and eventually a building form.

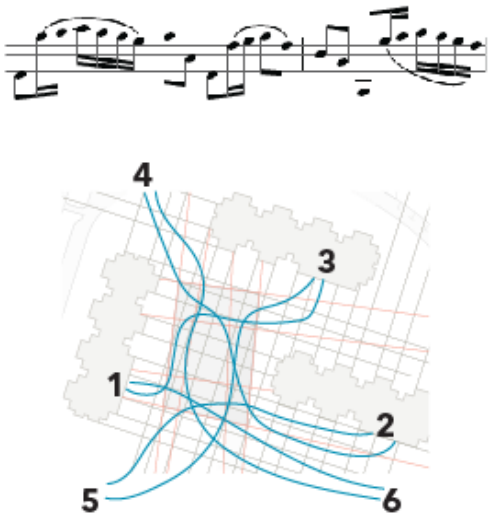
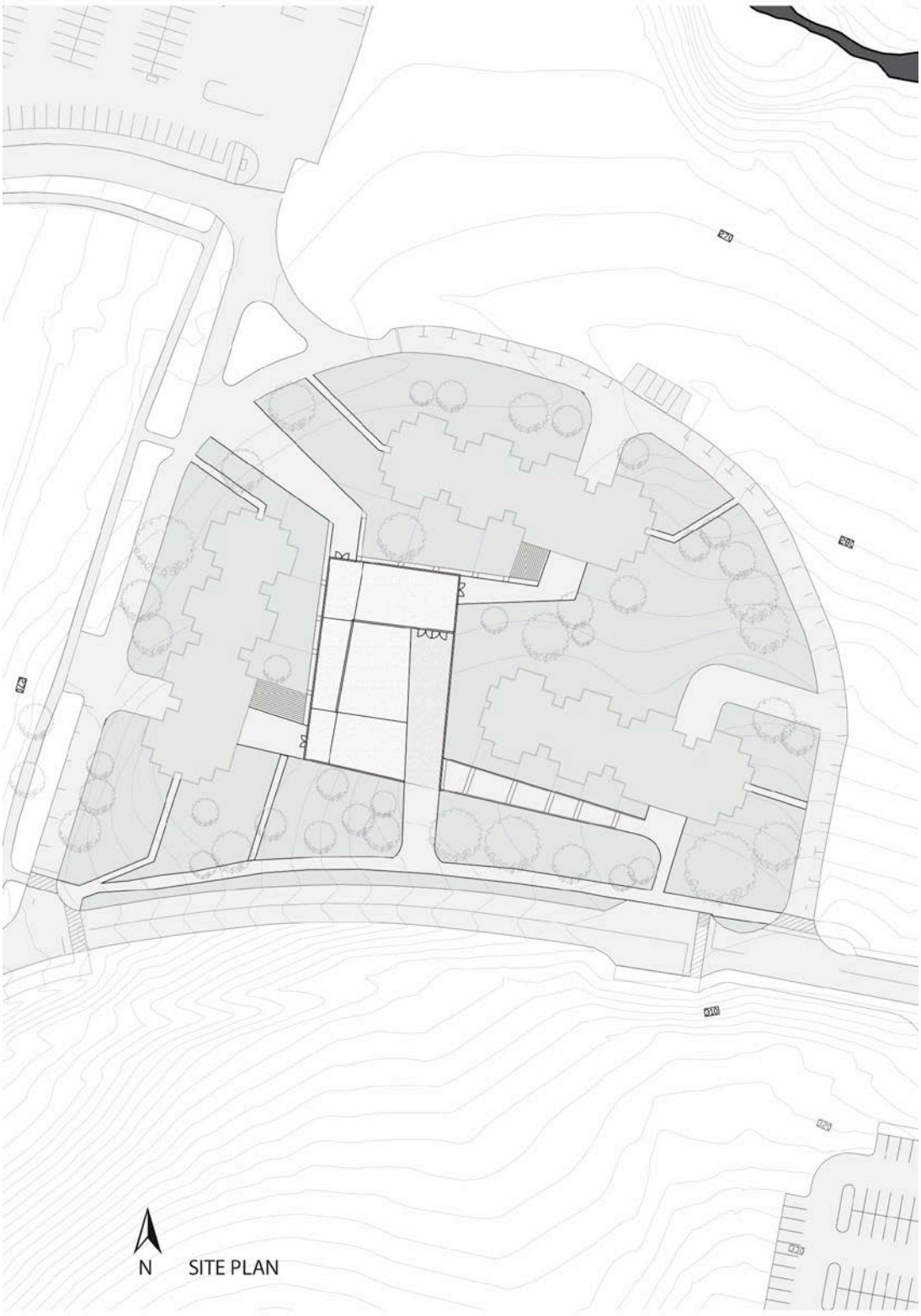


Figure 45. Diagram relating musical melody and circulation patterns
Image by author



46. Proposed site plan
Image by author

b) Interior Organization

Within the building, this offset syncopated language continues to dance, echoing across the tapered corridors, defining the interior organization of spaces, and dancing across elements of the interior elevations.

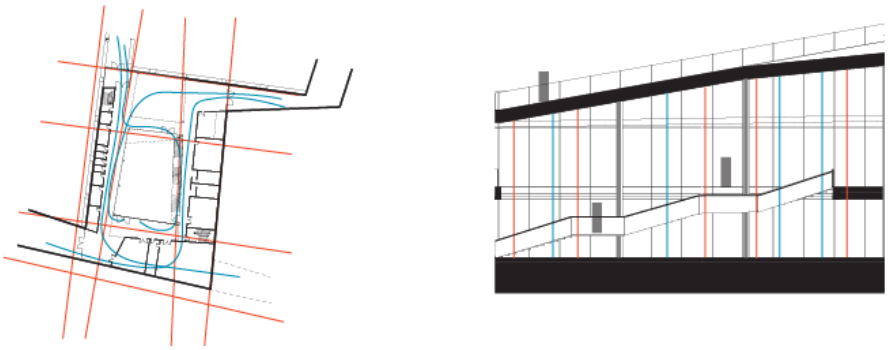


Figure 47. Diagram relating rhythm and melody to floor plan and interior elevation
Images by author

The heart of the building is a large auditorium that will be used for a variety of events, including art expositions, theatre, dance and music performances, guest speakers, and ceremonies. While massing out the building, I returned to the notion of music through time as a simultaneous spatial instance. Eventually I arrived at a form that expresses a grounded central mass, like the root note of a chord, with the rest of the mass growing up around, lending distinct spatial identity, as do the supporting notes of chords.

Figure 48. Photo of massing models
Image by author

Figure 49. First floor plan
Image by author

Figure 50. Second floor plan
Image by author

Figure 51. Third floor plan
Image by author

The interior of the building is characterized by the juxtaposition of compressed spaces and voluminous spaces, a result of the arrangement of programmatic elements each with their own dimensional requirements. These dramatic transitions are spatial translations of the indispensible music strategies of tension and release, and the incorporation of a variety of high and low moments of intensity, pivotal elements of a robust musical composition.

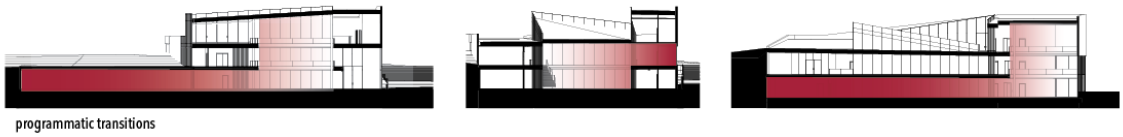


Figure 52. Diagram showing tension and release and transitions in building section
Images by author

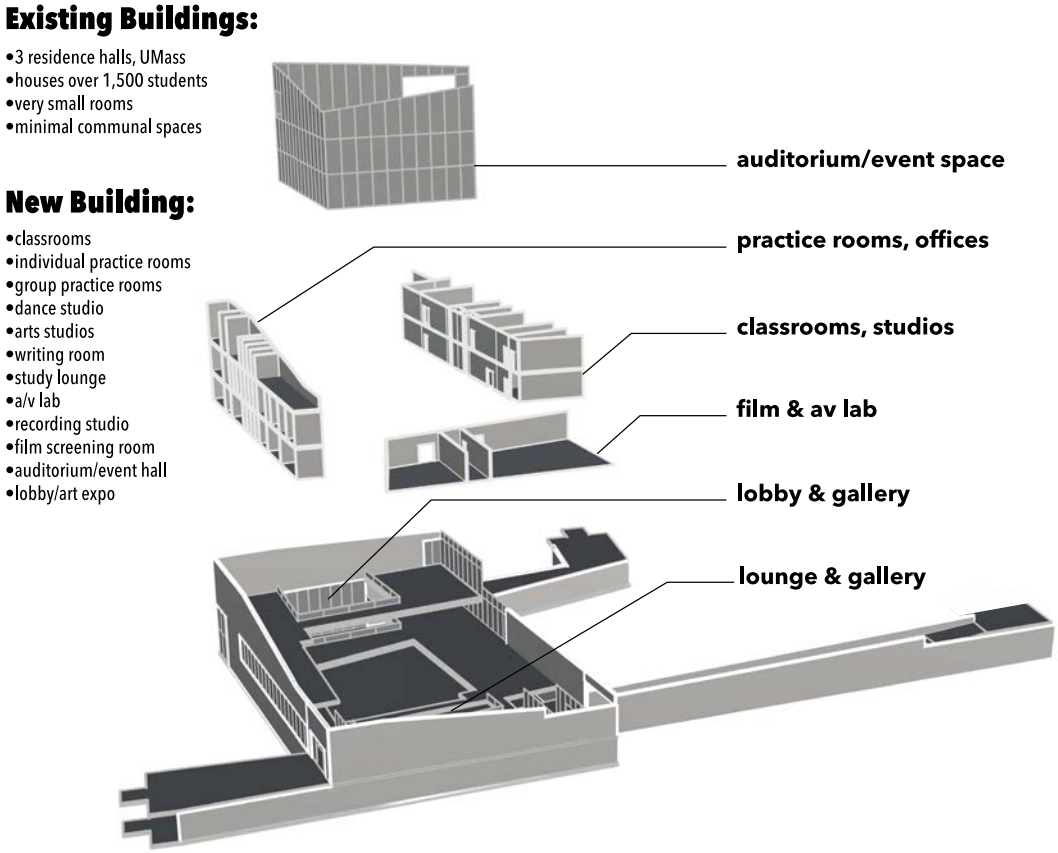


Figure 53. Diagram of programmatic spatial arrangement
Image by author

c) Central Auditorium

The central auditorium is a flexible multi-use space for concerts, dance performances, art exhibits, guest speakers, and presentations. The design strategies for any auditorium or performance space is a fascinating topic, since the space will have a direct impact on the way that individuals will perceive and therefore experience the events that will unfold within. Some designers and performers argue that a neutral, blank space is ideal, since it will not impact the performance. The issue here is that it is not possible to create a purely neutral space that imparts zero perceptual impact on a performance. Now, on the other end of the spectrum, others believe that the character of a space is integral to the performance itself, that a space should be crafted with the aim of sculpting a certain atmosphere is that will enhance the specific types of performances that it will host. The issue with this mindset, is that it reduces flexibility of the space.

This central auditorium borrows from both strategies, in order to achieve a space that not only accommodates all of the intended types of events, but also is also conducive to the goal of this building, to foster creativity and community. This is achieved in multiple ways: first, enclosing the space with translucent walls allows continuity from corridor to auditorium. This condition creates a dynamic interplay between observer and observed, with passers-by catching glimpses of the action within, or individuals inside at an event gazing out to catch a glimpses of individuals moving through the corridors. It welcomes all to be included in the events. In addition to this condition of translucency, the two balconies, the wide gradual stair, and the absence of permanent seating and stage, allow all sorts of configurations of performers and audience. This allows creative and experimental performance opportunities.

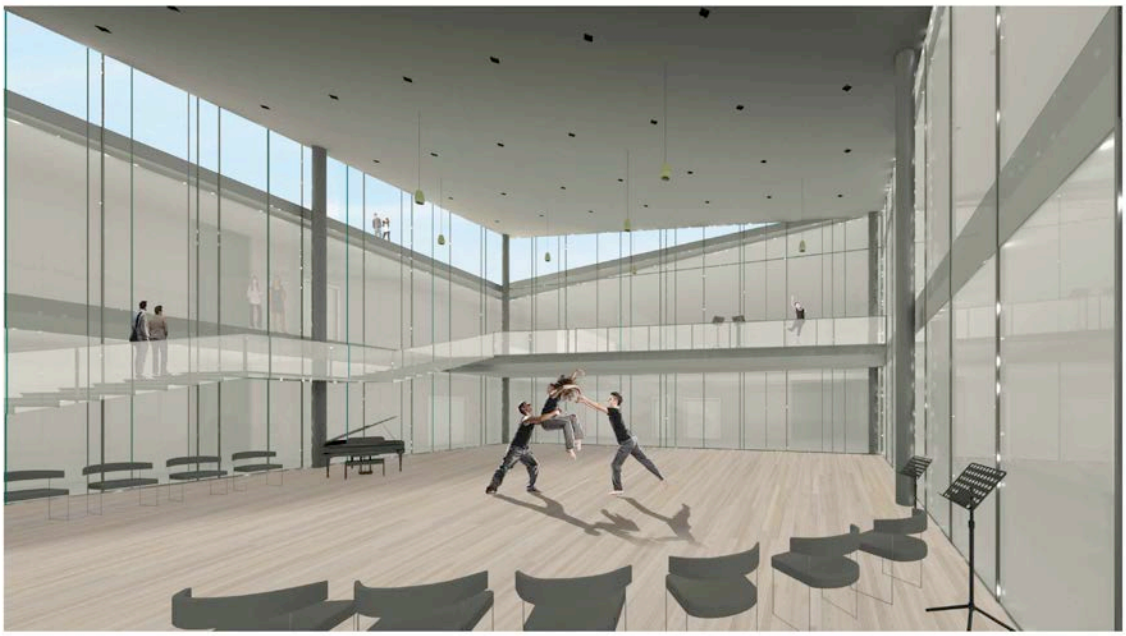


Figure 54. Rendering of central auditorium
Image by author

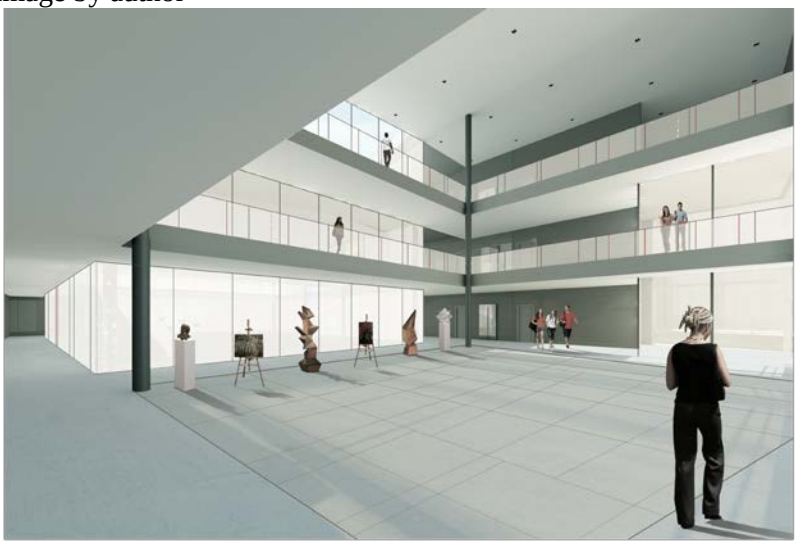


Figure 55. Rendering of lobby
Image by author

Triple-height lobby stands tall against the double-height of the central auditorium, and then continues up to define a third floor bridge, which gives onto the outdoor performance patio, or onto the roof surface that extends right back across to grade. Daylight enters the south-facing third floor aperture, and filters down through all three levels, illuminating the whole north portion of the building.

Figures 56. Rendering of third floor indoor-outdoor connection to patio, rendering of entrance from underground tunnel, rendering of exterior, evening, respectively. Images by author

d) Conclusion

Throughout the entire duration of this thesis process, the most challenging aspect was to control the trajectory of the investigation within this seemingly boundless world of inspirations and possibilities on the topic of music and architecture. With each new piece of research, it seemed that one could focus an entire project on that specific detail. As two major parts of my life, as I continue to explore the relationships between music and architecture in my personal and professional endeavors, I will continue to carve out more targeted, direct approaches.

The most meaningful piece of information that I will take away from this project (and that readers should take away from this project), is that music and architecture are such powerful and immersive art forms because of the fact that they both engage time *and* space.

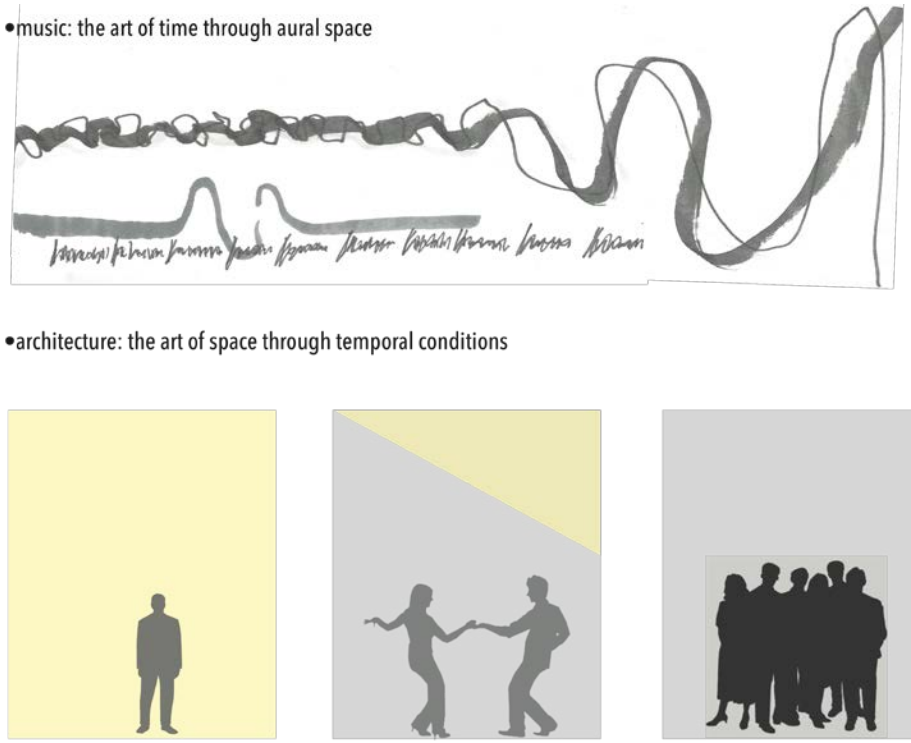


Figure 57. Diagram of space and time in music, and space and time in architecture
Images by author

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